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PART IV

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UNSTEADY LOW-SPEED WINDTUNNEL TEST  
OF A STRAKED DELTA WING, OSCILLATING IN PITCH

PART IV: PLOTS OF TIME HISTORIES OF PRESSURES AND OVERALL  
LOADS

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19. ABSTRACT (Continue on reverse if necessary and identify by block number) Results of a wind tunnel test of an oscillating straked wing. The report provides unsteady airloads and pressure distributions for a range of incidences (-8 to 50 deg.) and amplitudes (1 to 16 deg.). The wind speed was 80 meters/second, which provided reduced frequencies up to 0.50 based on root chord. The zeroth and first harmonic as well as the continuous time history of the pressure and overall loads were measured. Flow visualization was performed for flow of 30 meters/second using a pulsating laser light sheet. In part IV, the plots of time history data for both pressures and overall air loads for continuous oscillating model are presented for conditions in which non-linearities and higher harmonics are expected. Appendix A includes the pressure plots in a "carpet" format which shows the distributions at every 45 deg of phase angle in a manner similar to the unsteady flow visualization photos. The distributions are shown similarly for all four pressure sections. (See reverse)					
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Persoon, A.J.,	"	"	"	"	"
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Retel, A.P.,	"	"	"	"	"
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Zwaan, R.J.,	"	"	"	"	"
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19. ABSTRACT CONTD

A survey of the test conditions and their runnumbers is given in table 10 of part I.

Appendix B includes plots of overall air loads vs. incidence for continuous oscillating model. A survey of the runnumbers of these plots is given in table 11 of part I.

FOREWORD

This report summarizes the results of the windtunnel test of an oscillating straked wing conducted under a cooperative program of research between General Dynamics Fort Worth Division, Fort Worth, Texas, and the National Aerospace Laboratory (NLR), The Netherlands. The model and support system was designed and fabricated at NLR under a separate program with General Dynamics and NLR funding. The test preparation, wind-tunnel test and reporting were performed at NLR under Air Force Contract F33615-85-C-3013, for the Flight Dynamics Laboratory of the Air Force Wright Aeronautical Laboratories, Wright-Patterson Air Force Base, Ohio. The work was administered by Mr. D.W. Kinsey of the Aeromechanics Division (AFWAL/FIM). Additional technical monitoring support was provided by Mr. T. Cord of the Flight Control Division (AFWAL/FIG).

The program manager and principal investigator was Dr. A.M. Cunningham Jr. at General Dynamics and Mr. R.G. den Boer was the principal investigator at NLR. Mr. den Boer was assisted by the following NLR specialists: C.S.G. Dogger, E.G.M. Geurts, A.J. Persoon, A.P. Retèl and R.J. Zwaan.

This report consists of six parts. Part I presents a general description of the model and test program and a discussion of the results. Part II contains the steady pressure distribution plots and the major part of the zeroth and first order harmonic unsteady pressure distribution plots. Part III contains the remainder of the unsteady pressure distribution plots and plots of the steady and the zeroth and first order harmonic unsteady overall loads. Part IV contains time history plots of the unsteady pressures and overall loads. Part V contains power spectral density plots of the overall loads at harmonic oscillation and time history plots of overall loads for (1-cos) model motions. Part VI contains results of the flow visualization program.



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LIST OF SYMBOLS

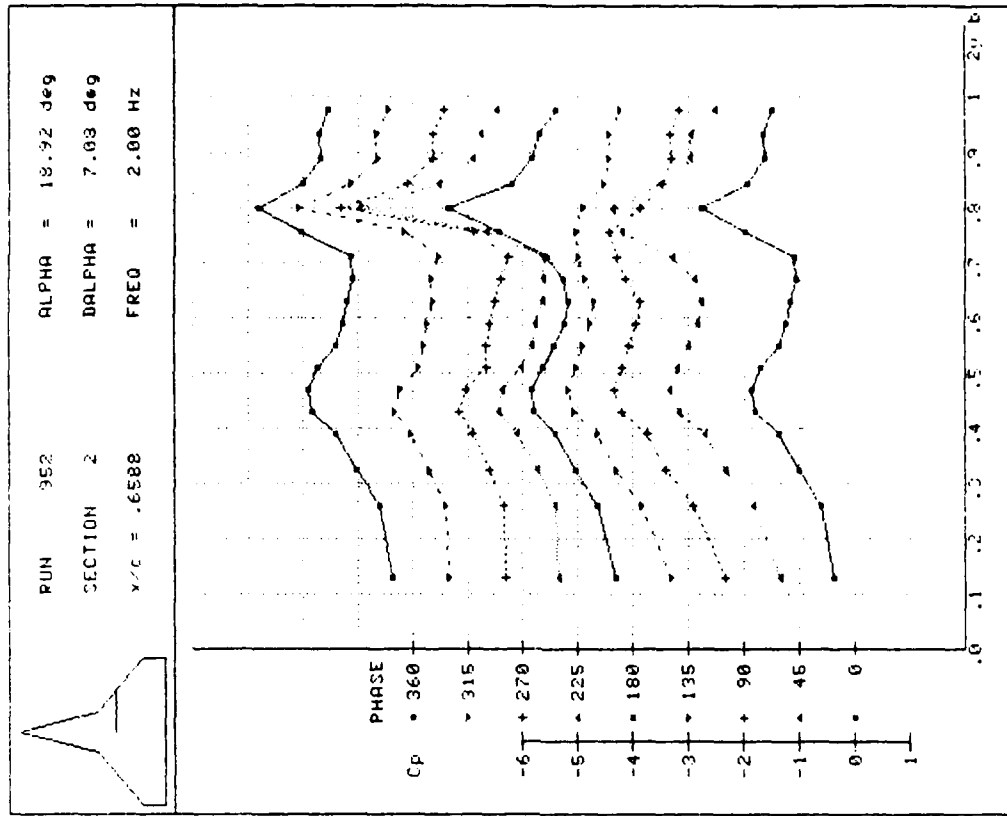
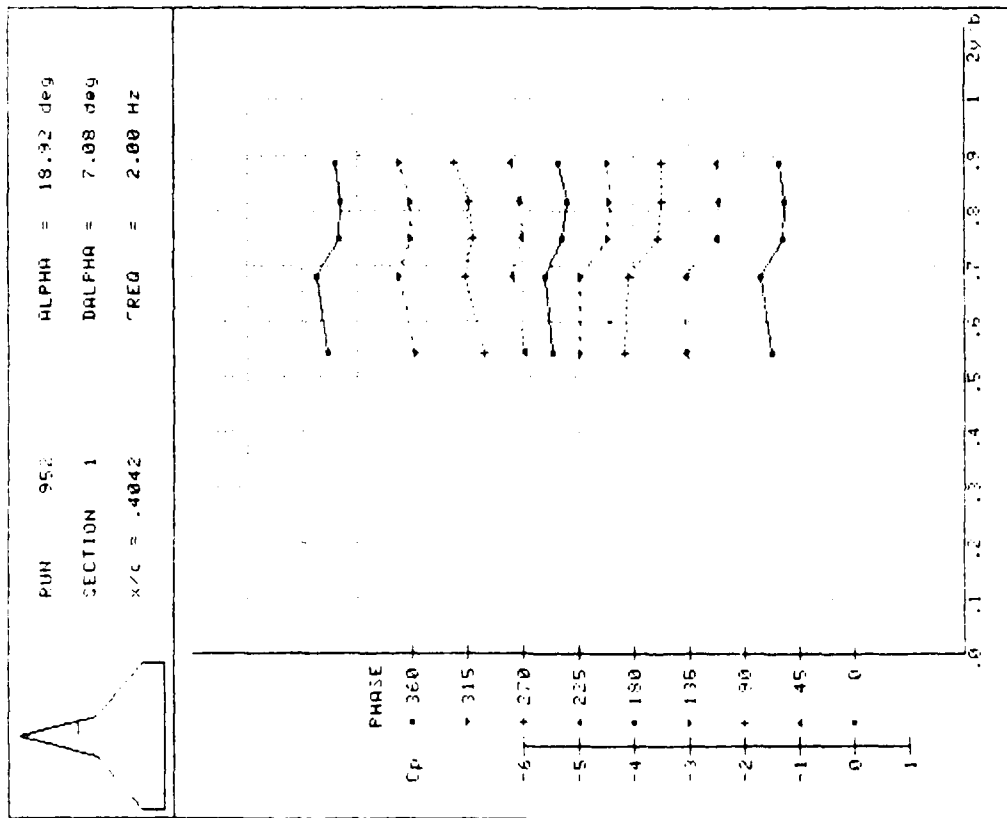
ALPHA, $\alpha$	wing incidence	(deg)
b	local wing span	(m)
bw	wing span (bw = 0.8000)	(m)
BETA, $\beta$	sideslip angle	(deg)
c	local chord	(m)
Cl	wing rolling moment coefficient	
Cm	wing pitching moment coefficient	
	ref. axis = rotation axis $x/cr = 73.27\%$	
Cn	wing yawing moment coefficient	
CN	wing normal force coefficient	
Cp	pressure coefficient	
cr	root chord (cr = 0.7855)	(m)
CT	wing tangential force coefficient	
CY	wing side force coefficient	
DALPHA, $d\alpha$	harmonic oscillation: amplitude of unsteady wing incidence	(deg, rad)
f, FREQ	frequency	(Hz)
l	wing rolling moment (figure 1, part I)	(Nm)
m	wing pitching moment (figure 1, part I)	
	ref. axis $x/cr = 73.27\%$	(Nm)
n	wing yawing moment (figure 1, part I)	(Nm)
N	wing normal force (figure 1, part I)	(Nm)
RUN	run number	
t	time	(s)
T	wing tangential force (figure 1, part I)	(N)
	apex: $x=0$ (figures 1, 5, part I)	
y	spanwise coordinate in wing reference plane (figures 1, 5, part I) y-axis is the rotation axis; $x/cr = 73.27\%$	(N)
Y	wing side force (figure 1, part I)	(N)
<u>GREEK</u>		
$\alpha$ , ALPHA	wing incidence	(deg)
$d\alpha$ , DALPHA	harmonic oscillation: amplitude of unsteady wing incidence	(deg, rad)
$\beta$ , BETA	sideslip angle	(deg)

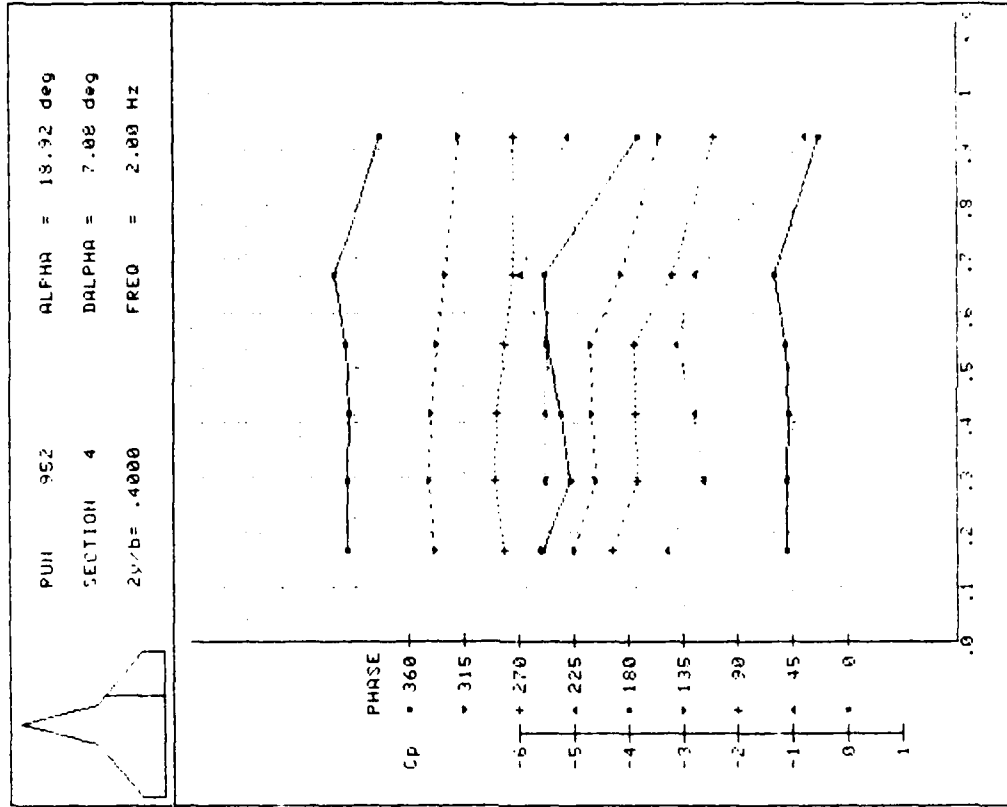
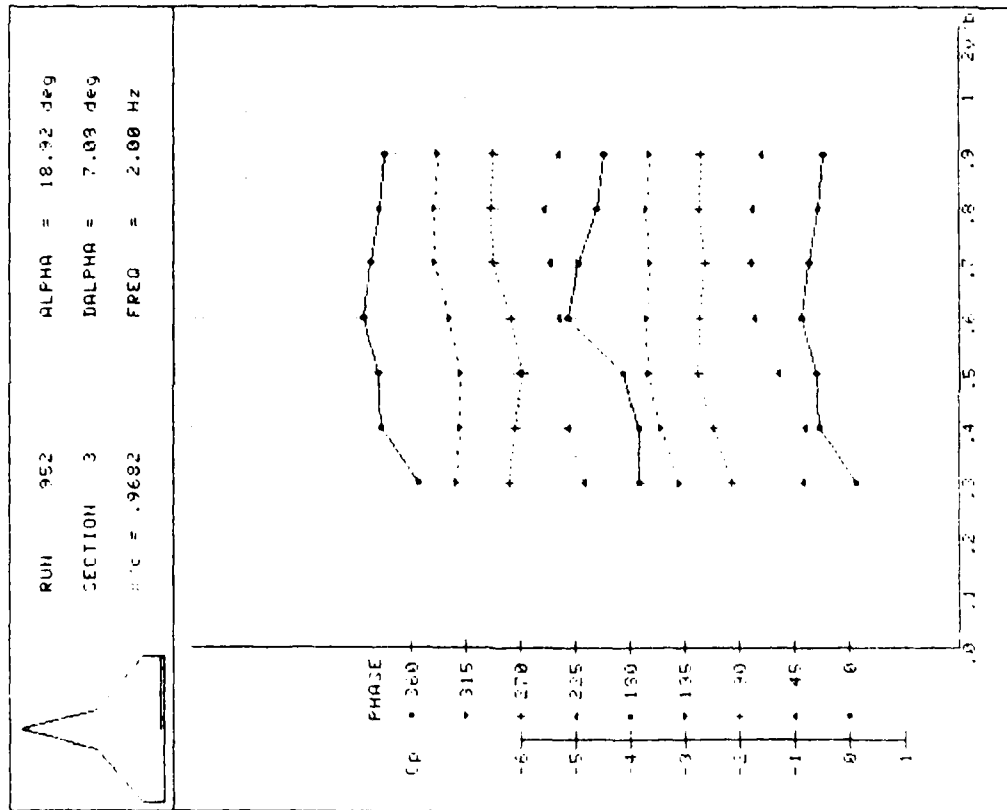
APPENDIX A  
PLOTS OF TIME HISTORIES OF PRESSURES  
FOR CONTINUOUS OSCILLATING MODEL

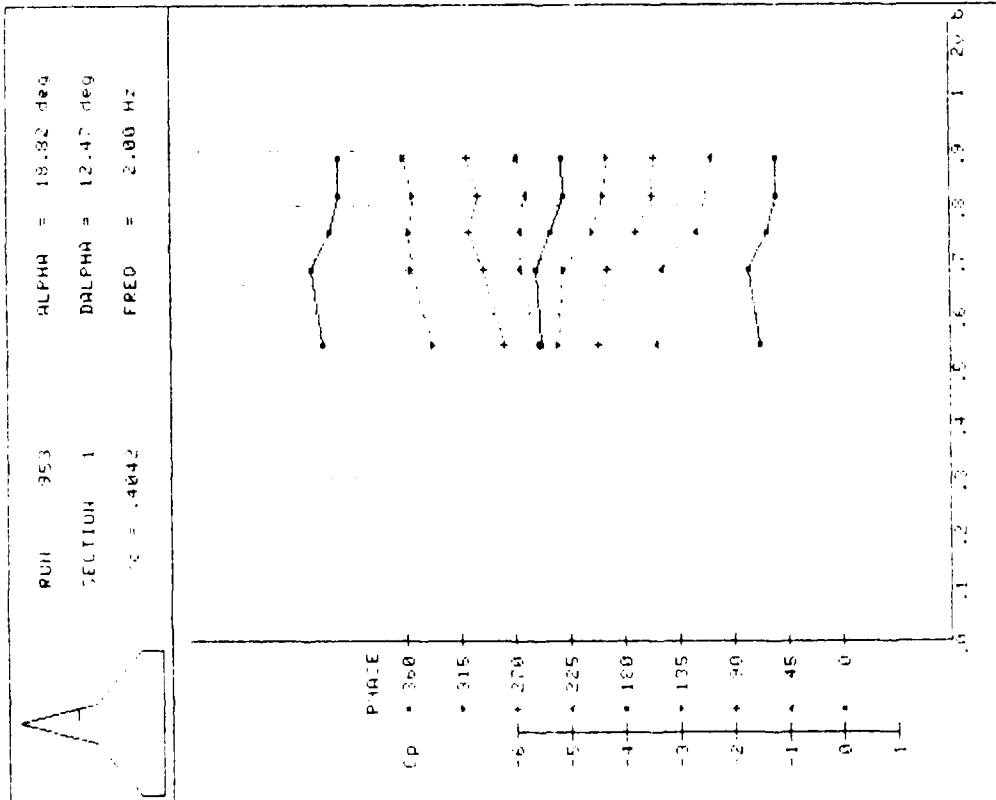
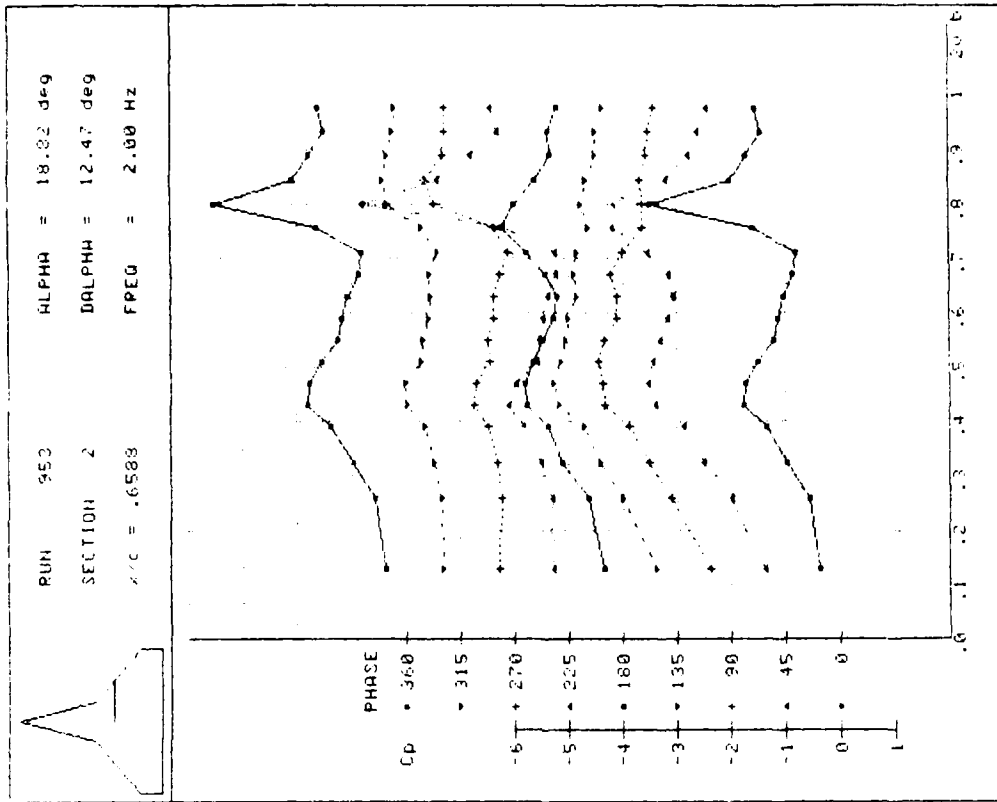
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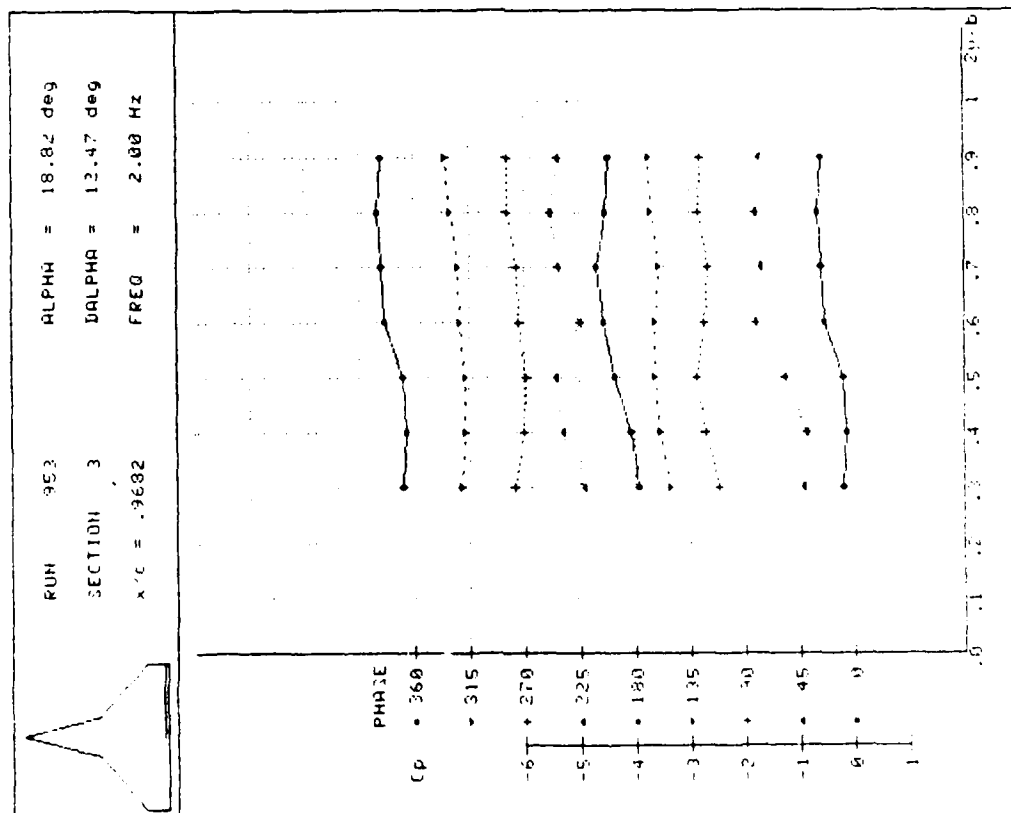
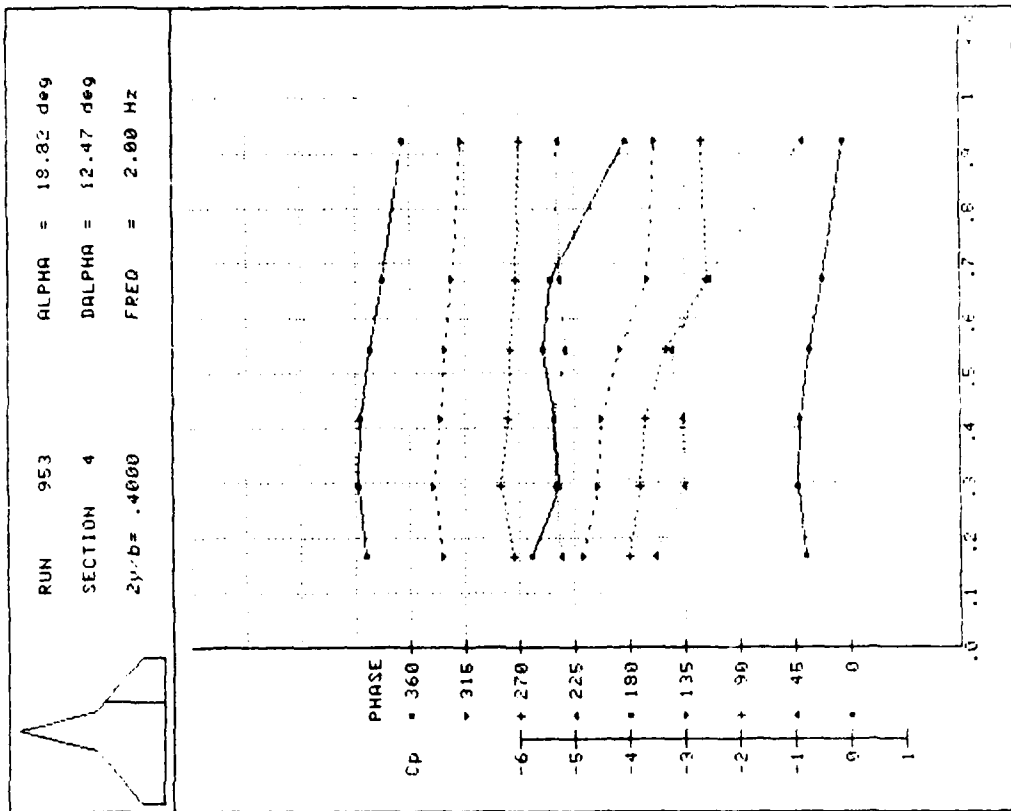
- \*  $x/c$  indicates the position of the pressure sections relative to the root chord ( $c_r = 0.7855$  m),
- \*  $2y/b$  indicates the position of the pressure section relative to the wing span ( $b_w = 0.8000$  m).

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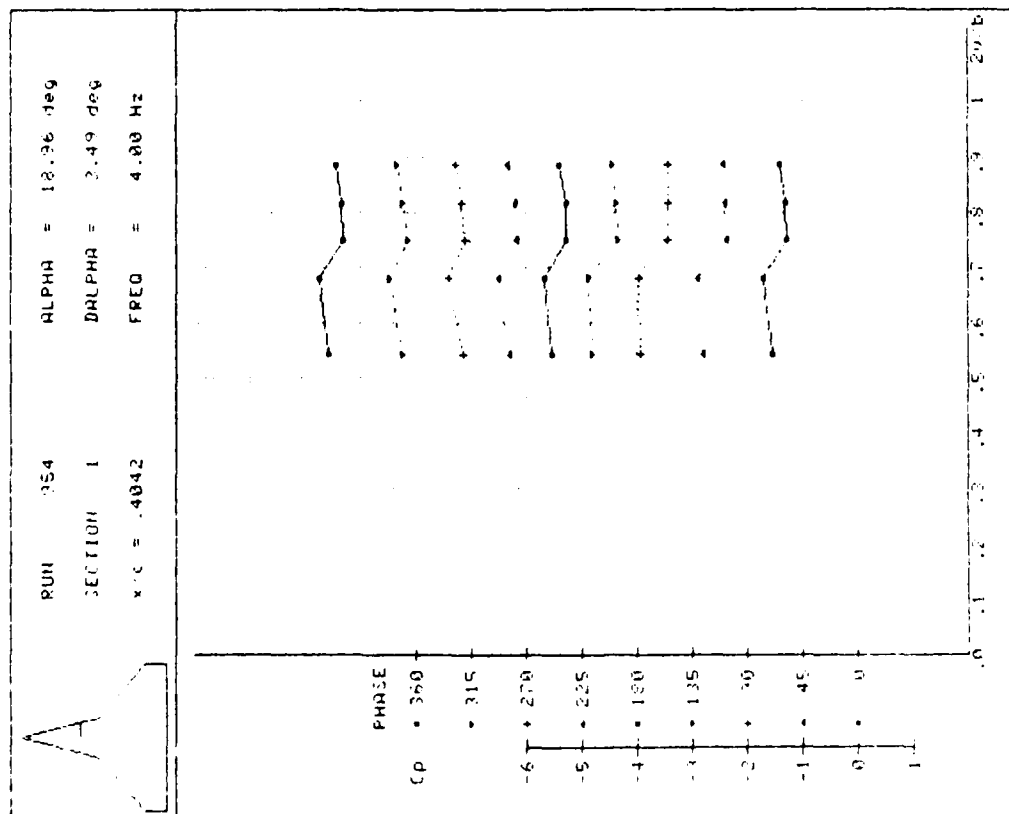
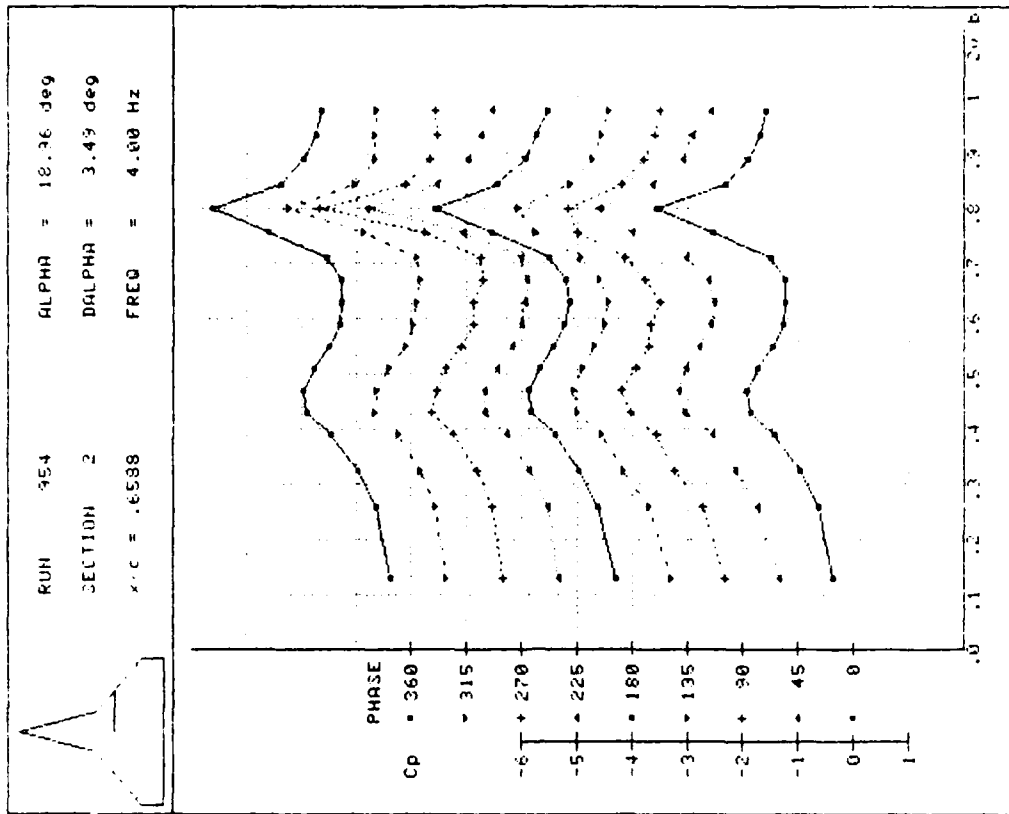


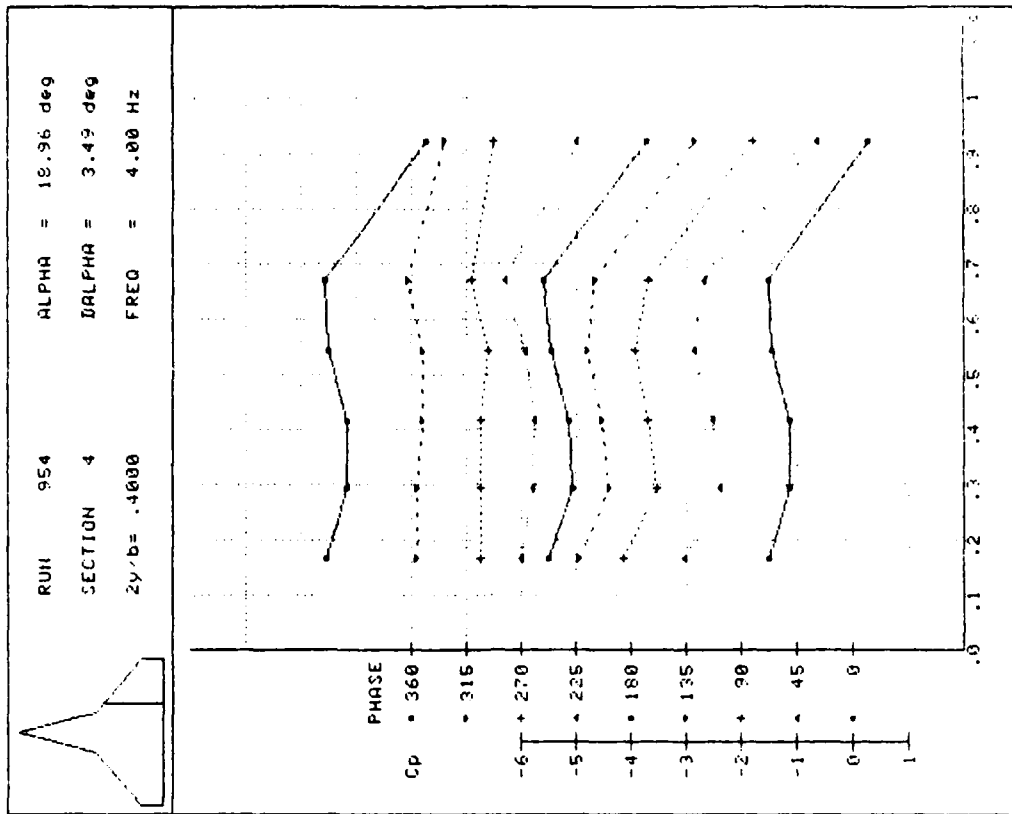
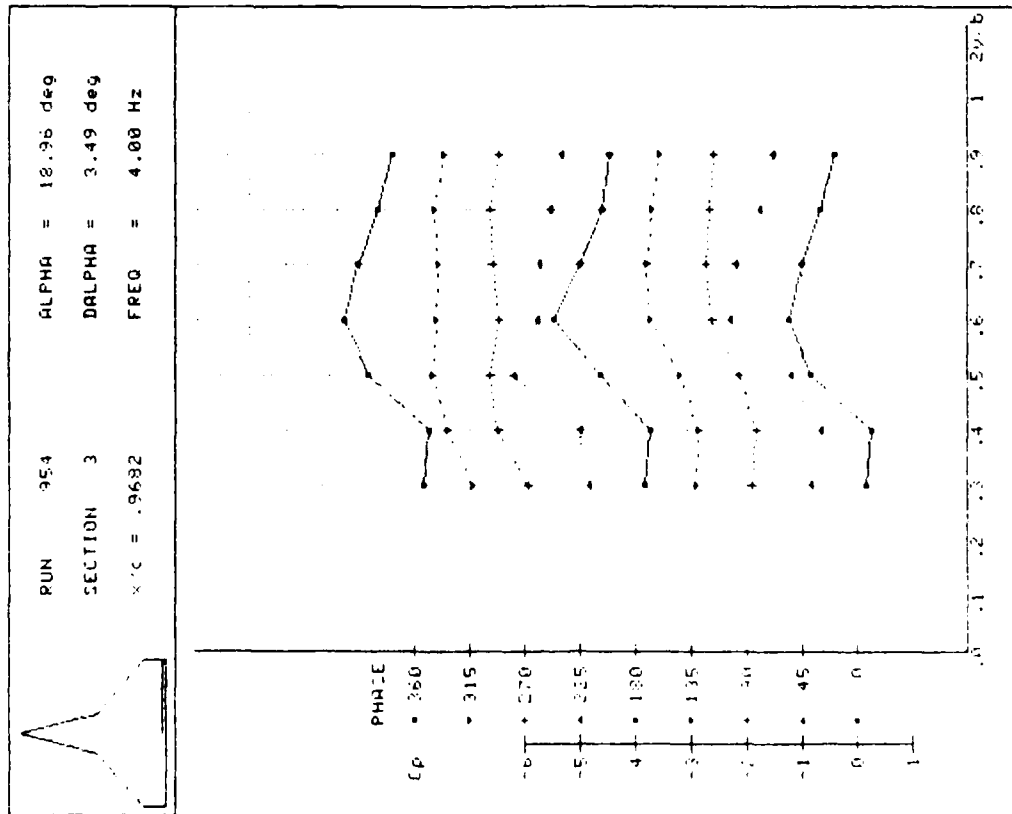


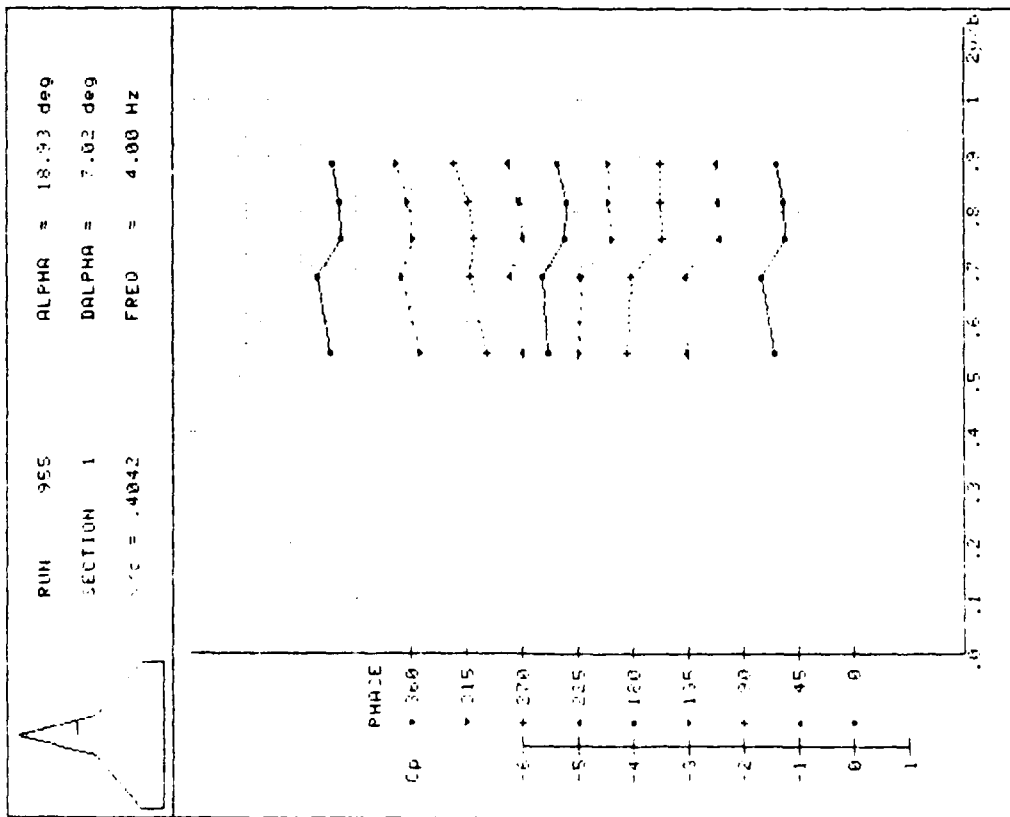
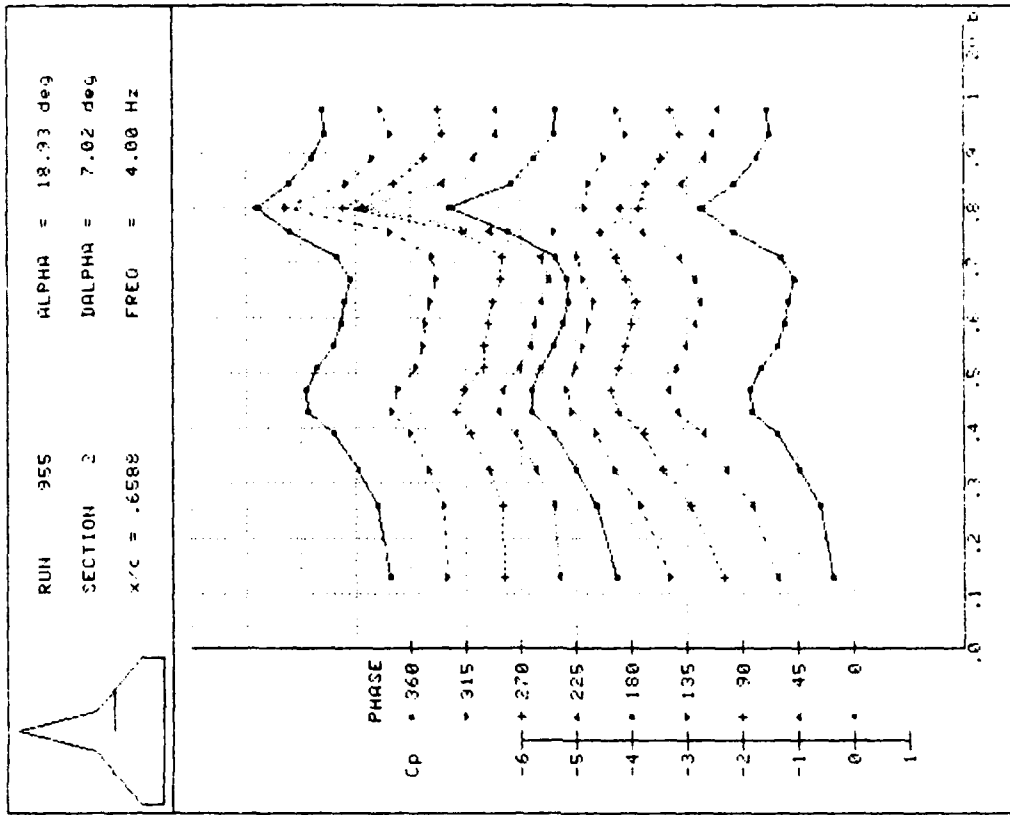


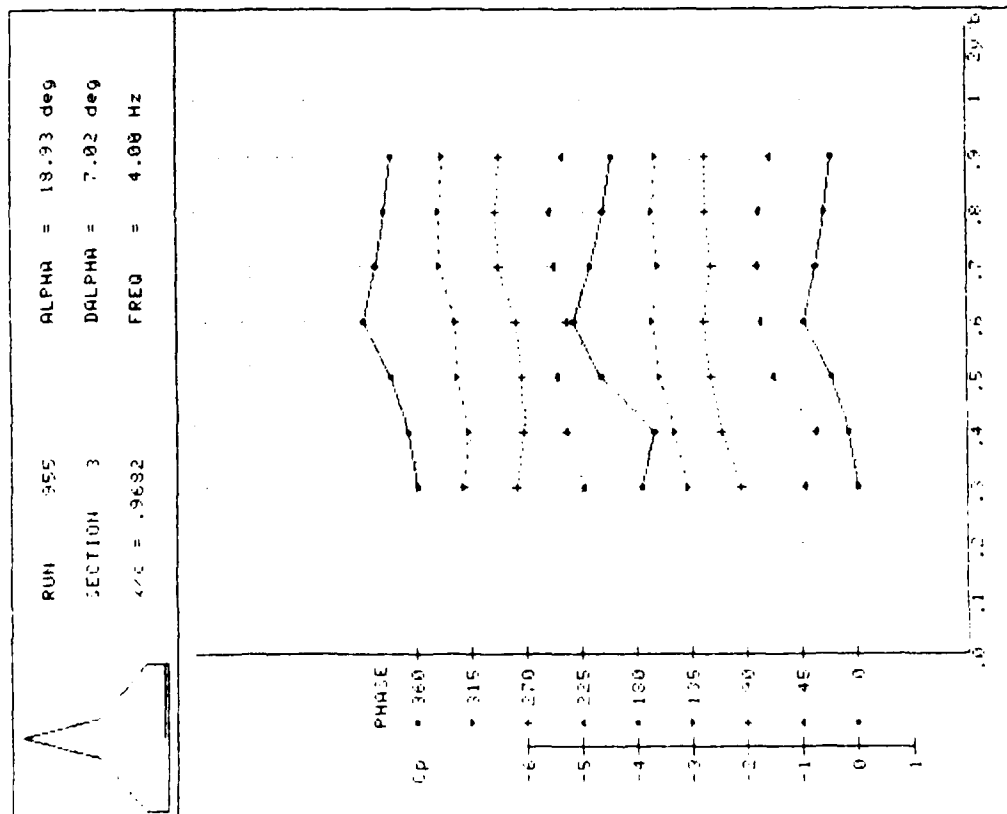
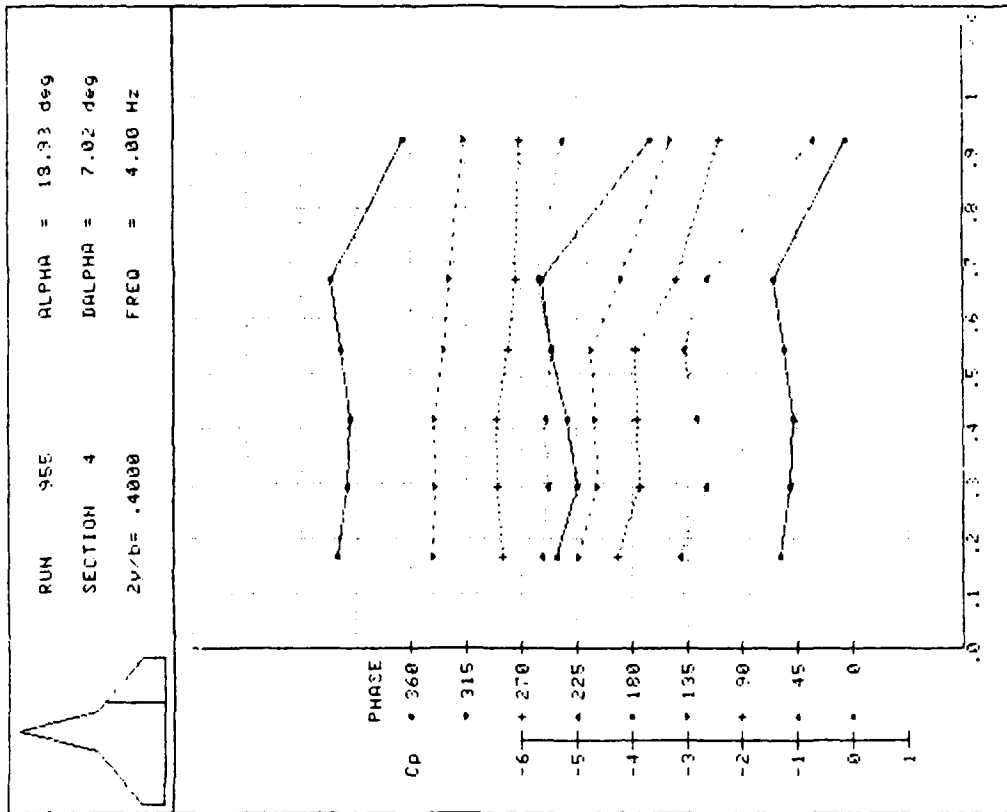


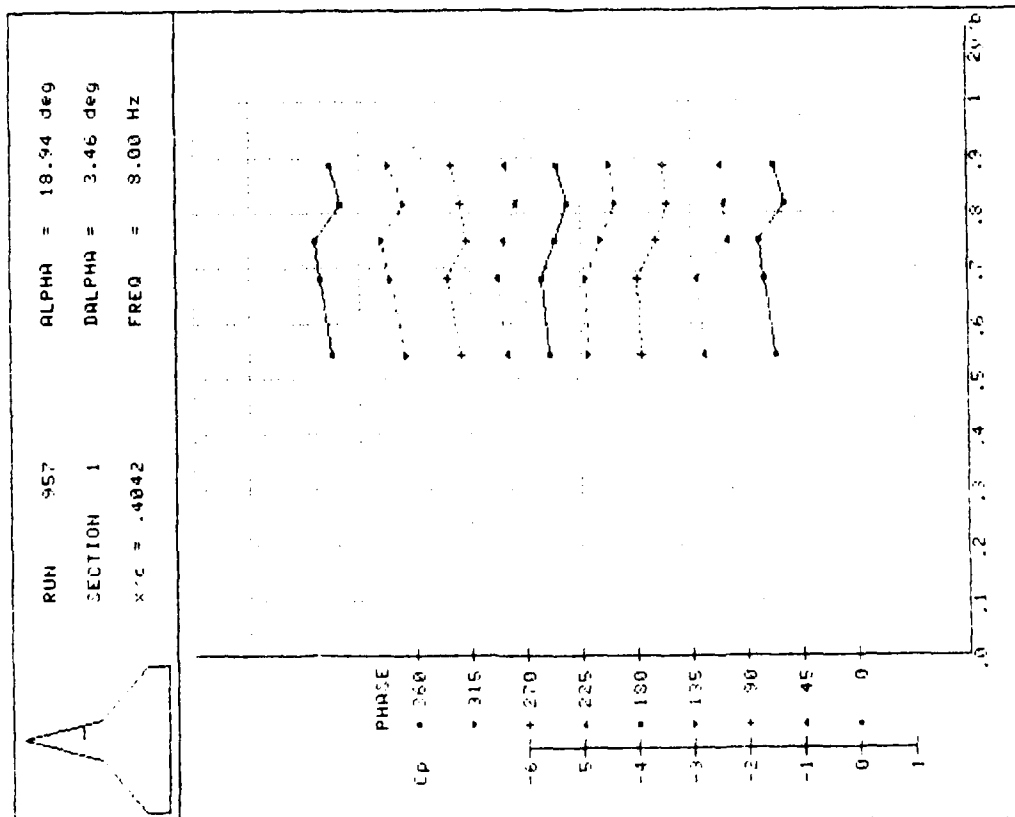
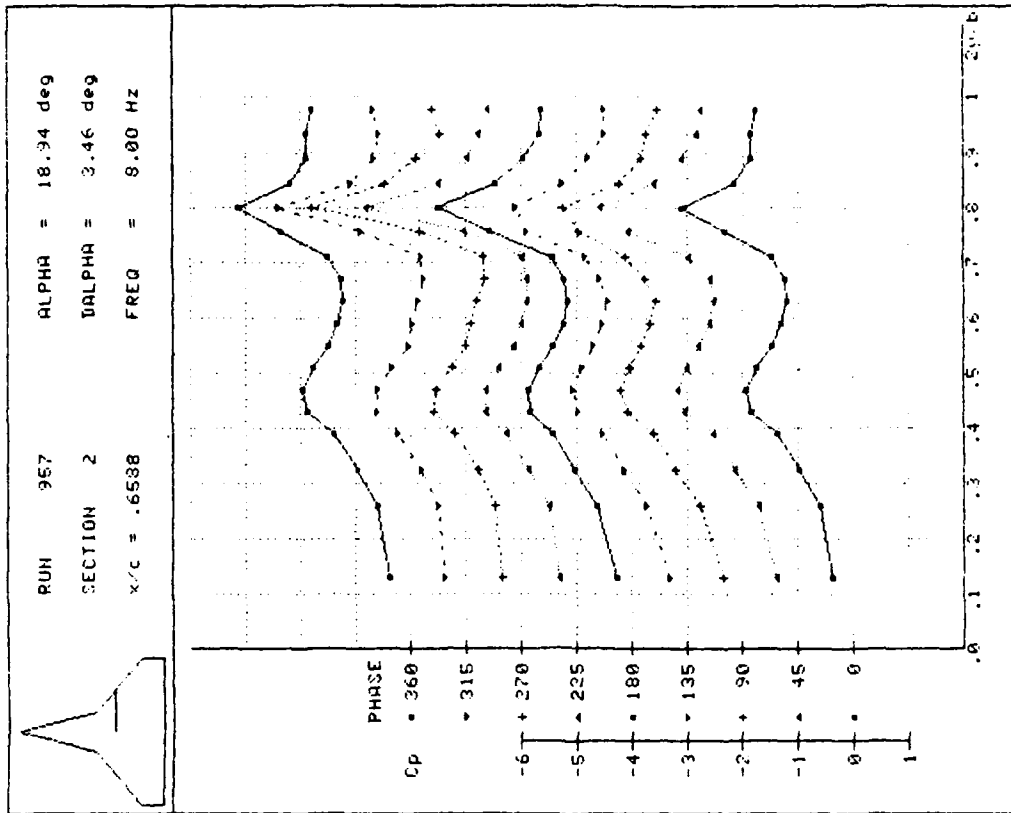


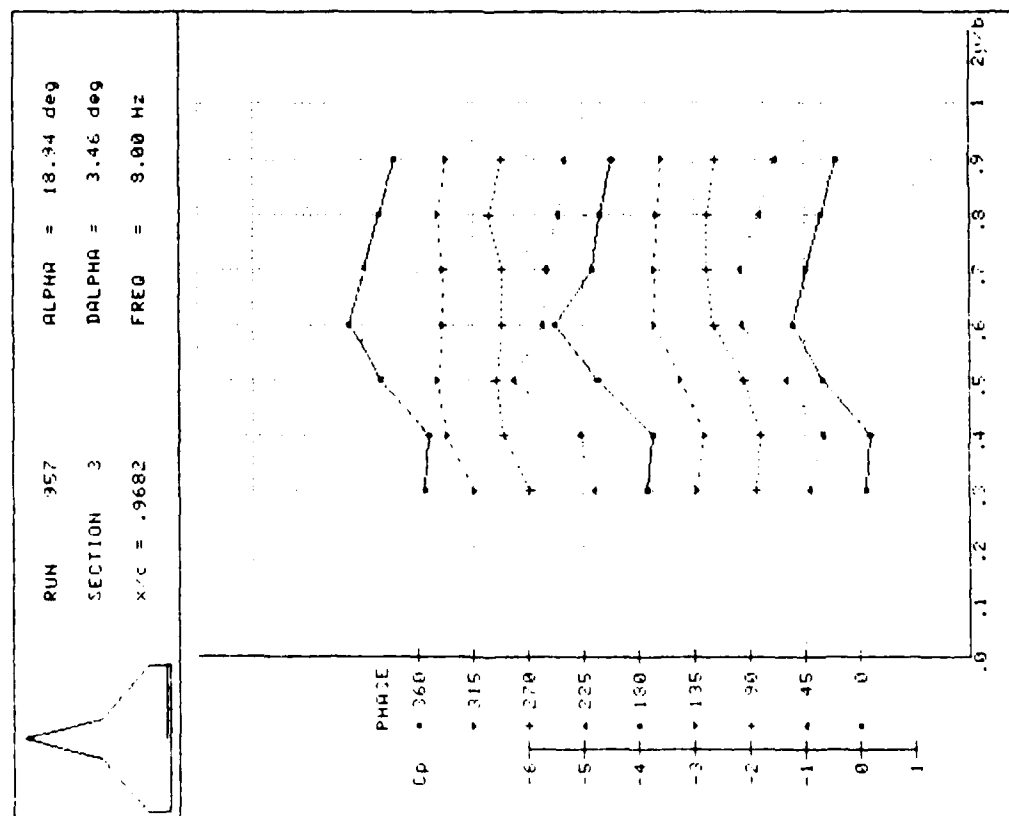
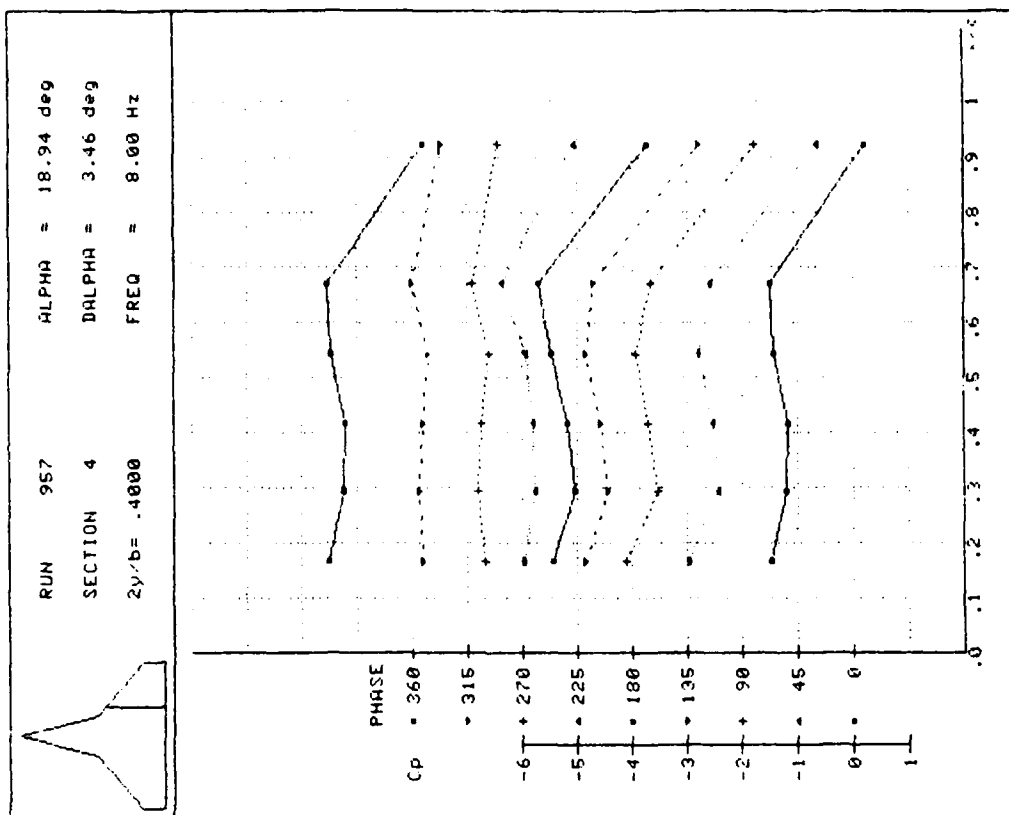


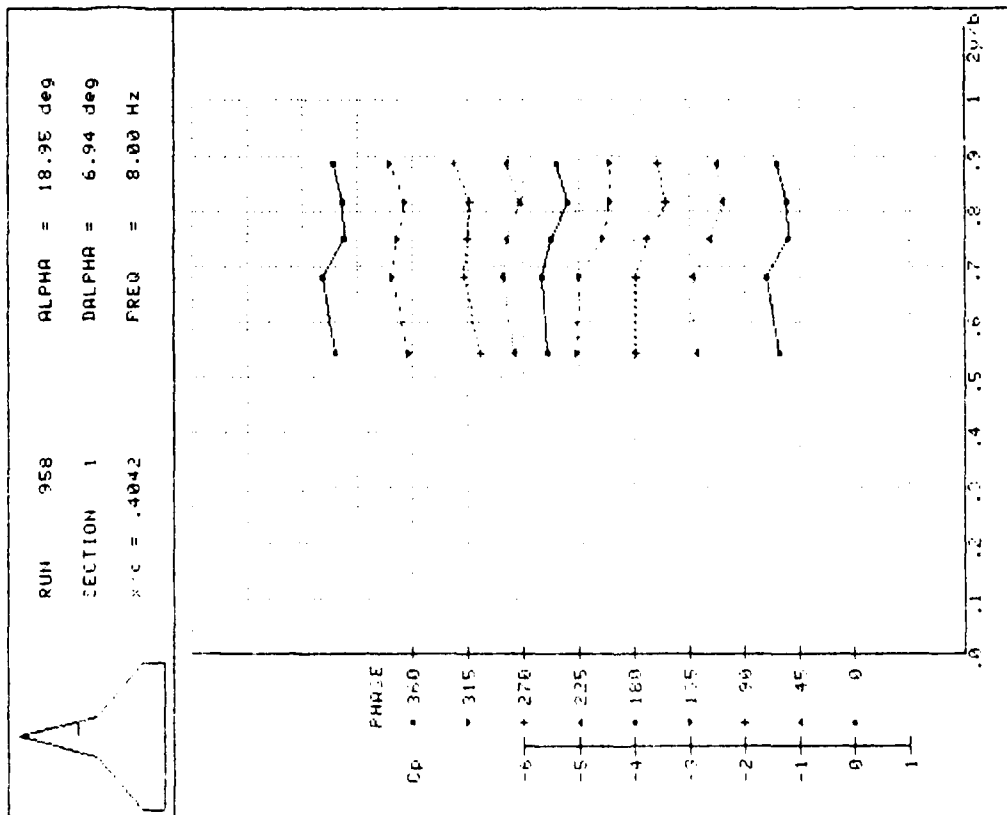
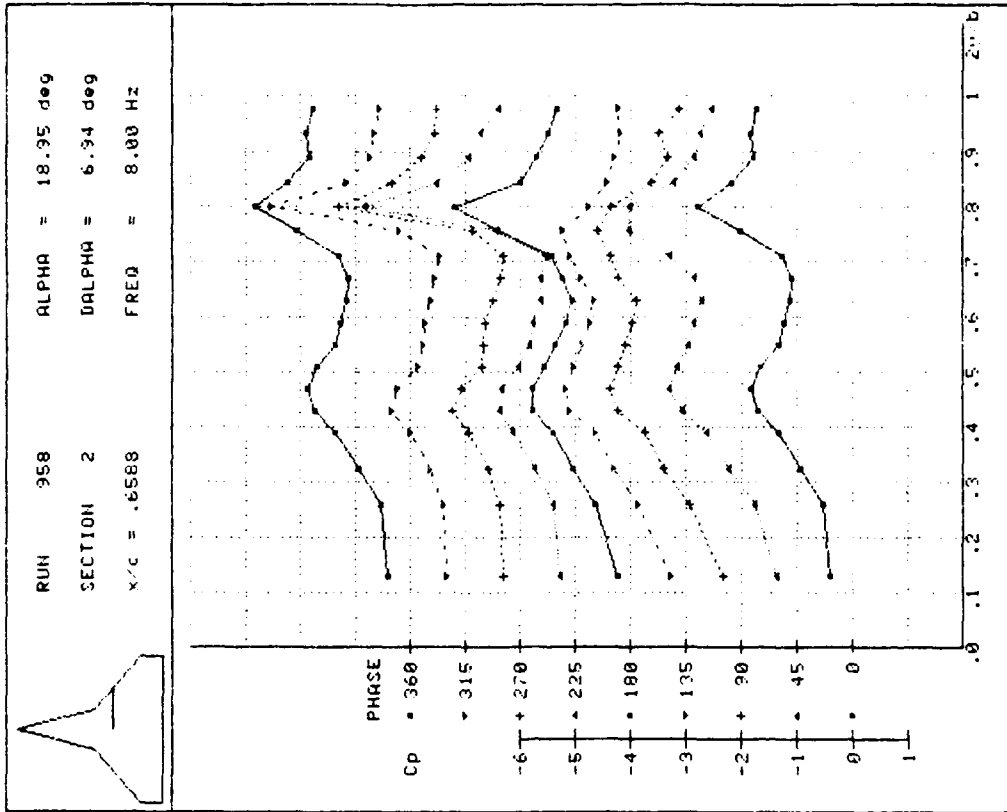


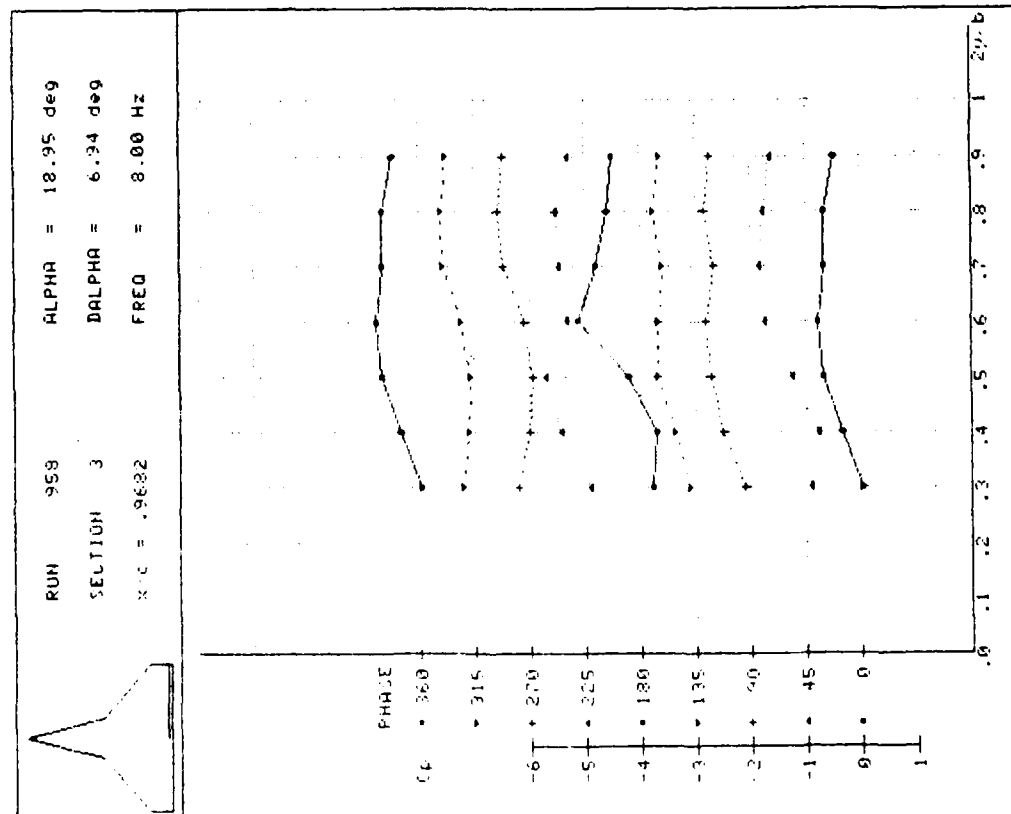
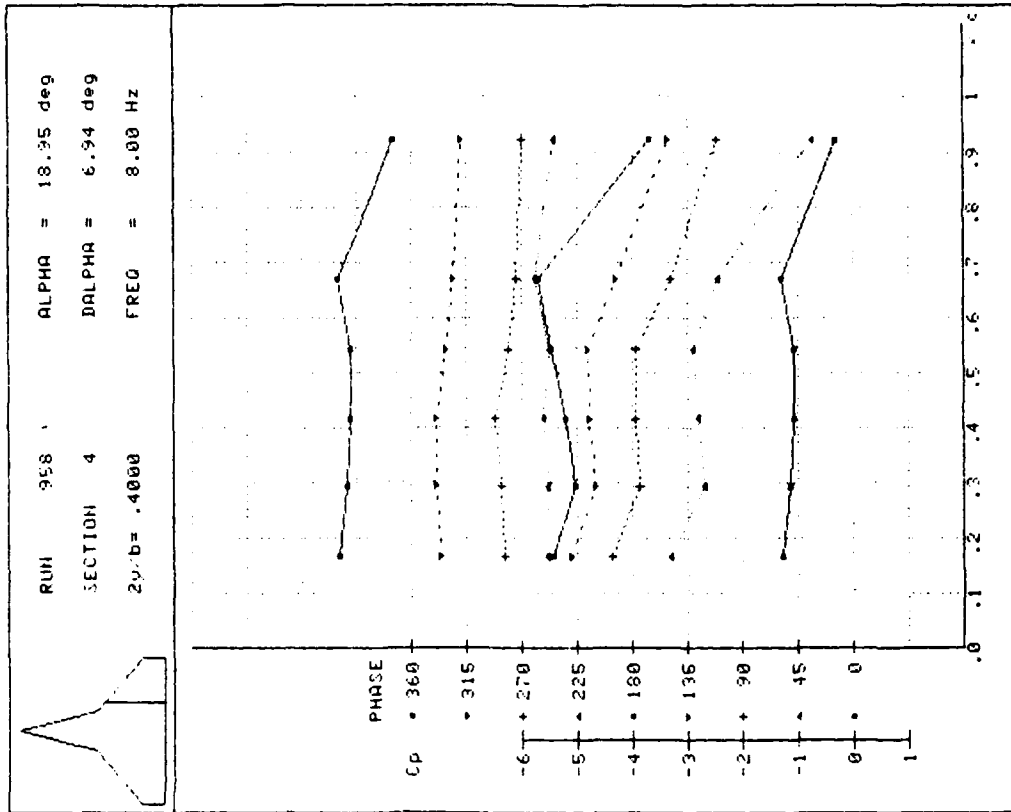




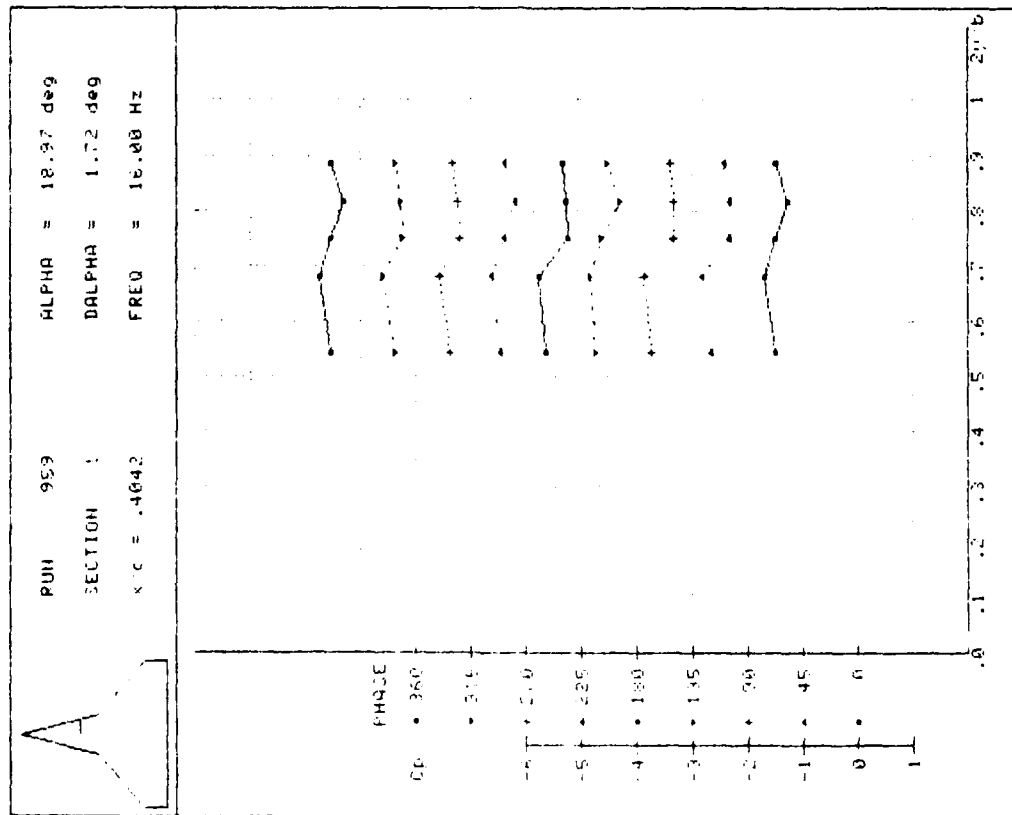
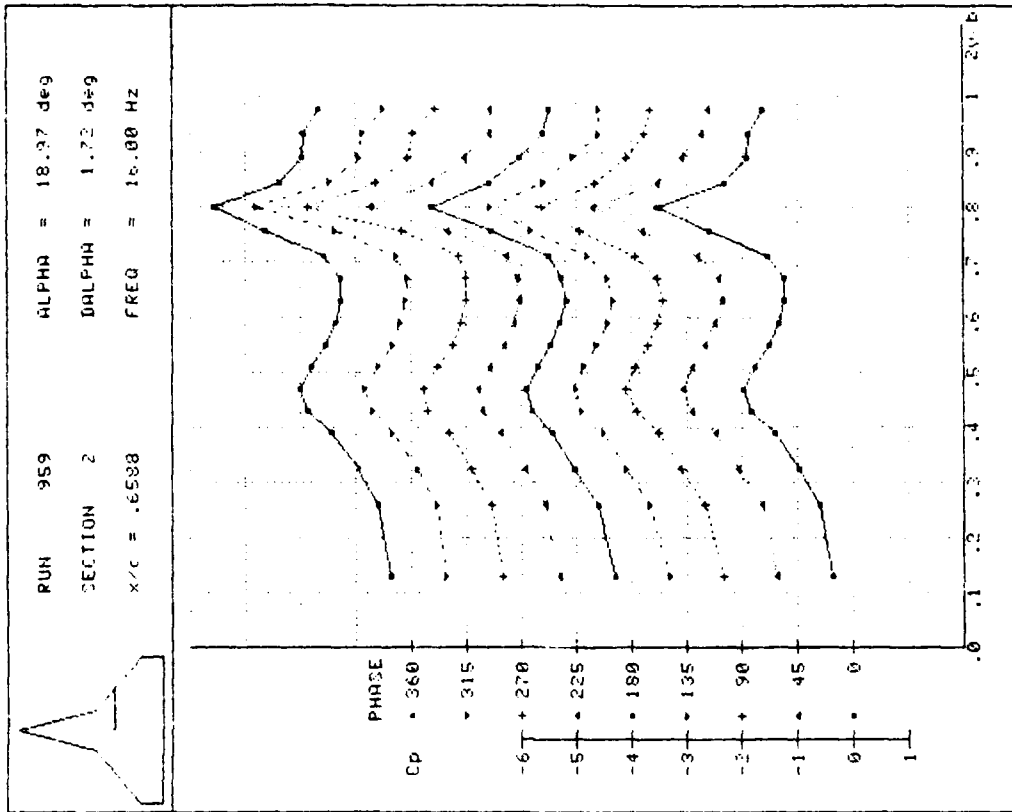


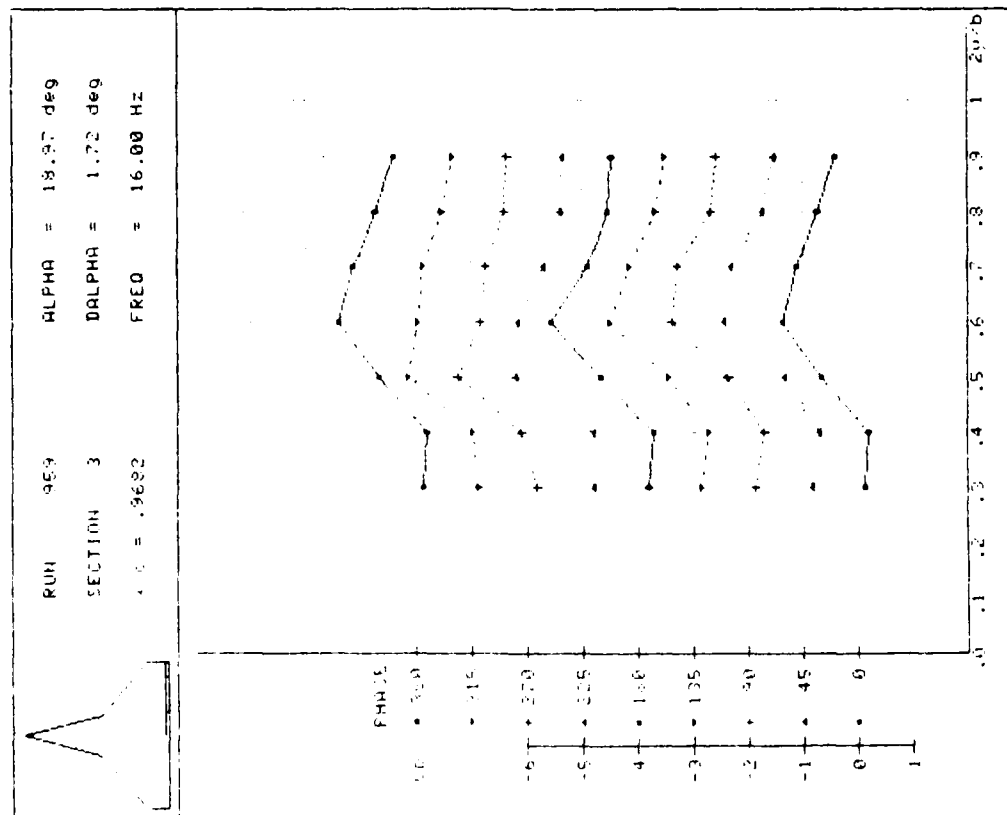
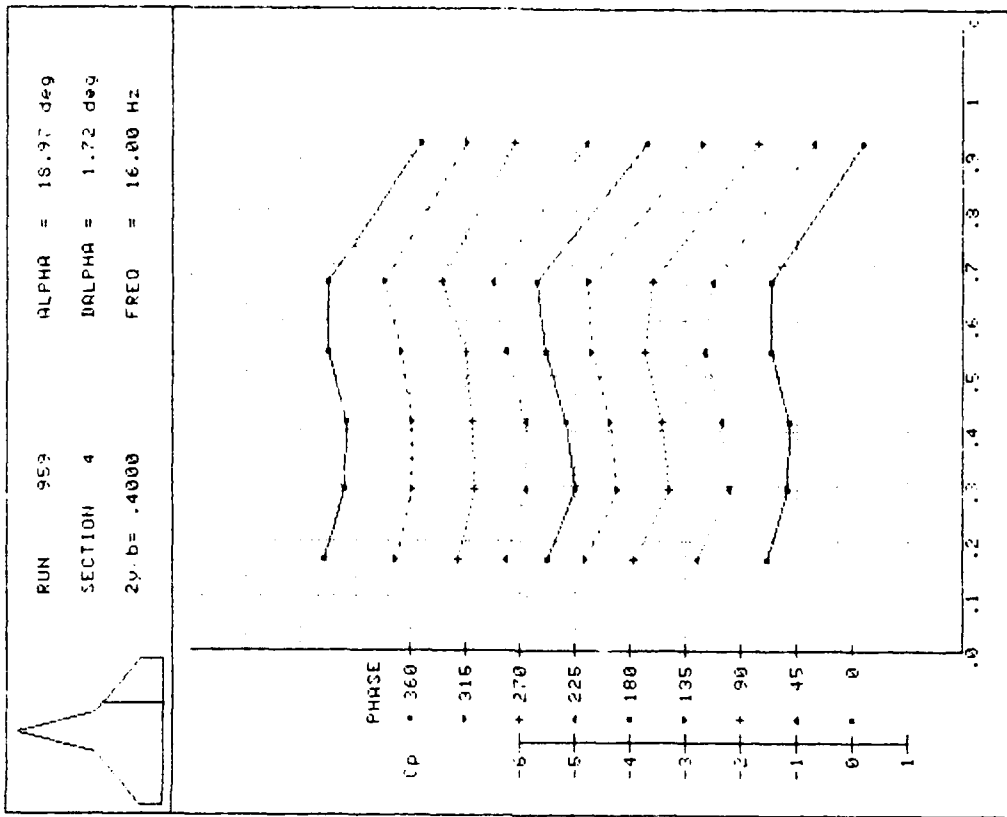


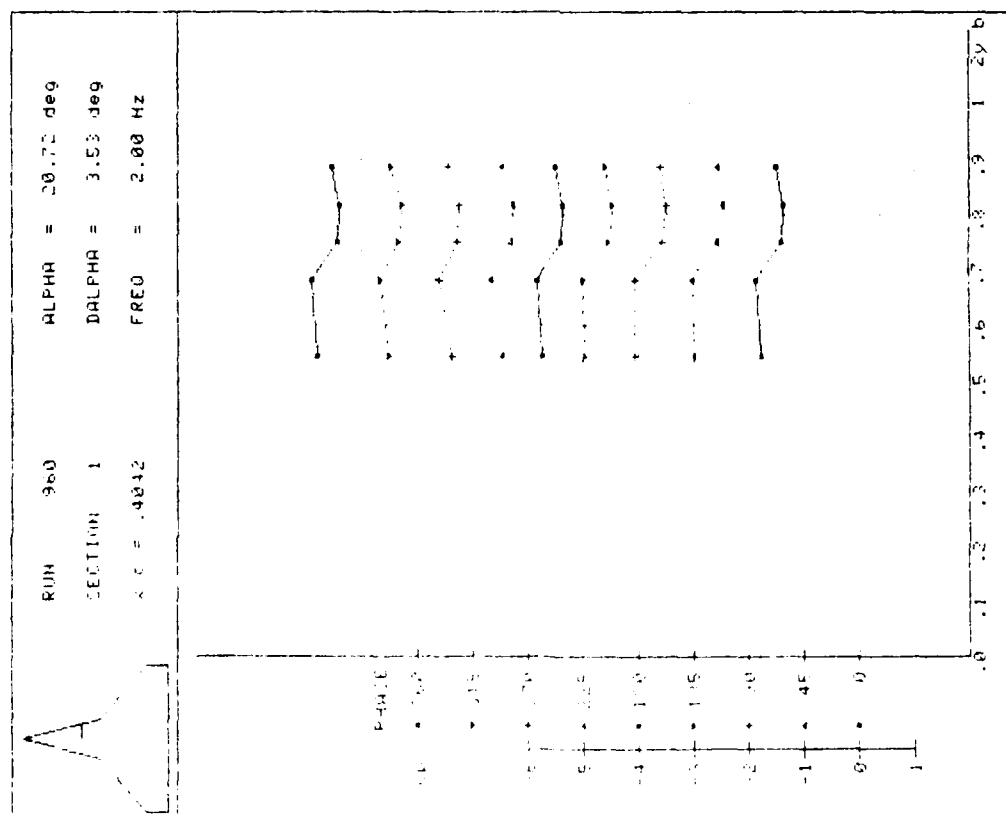
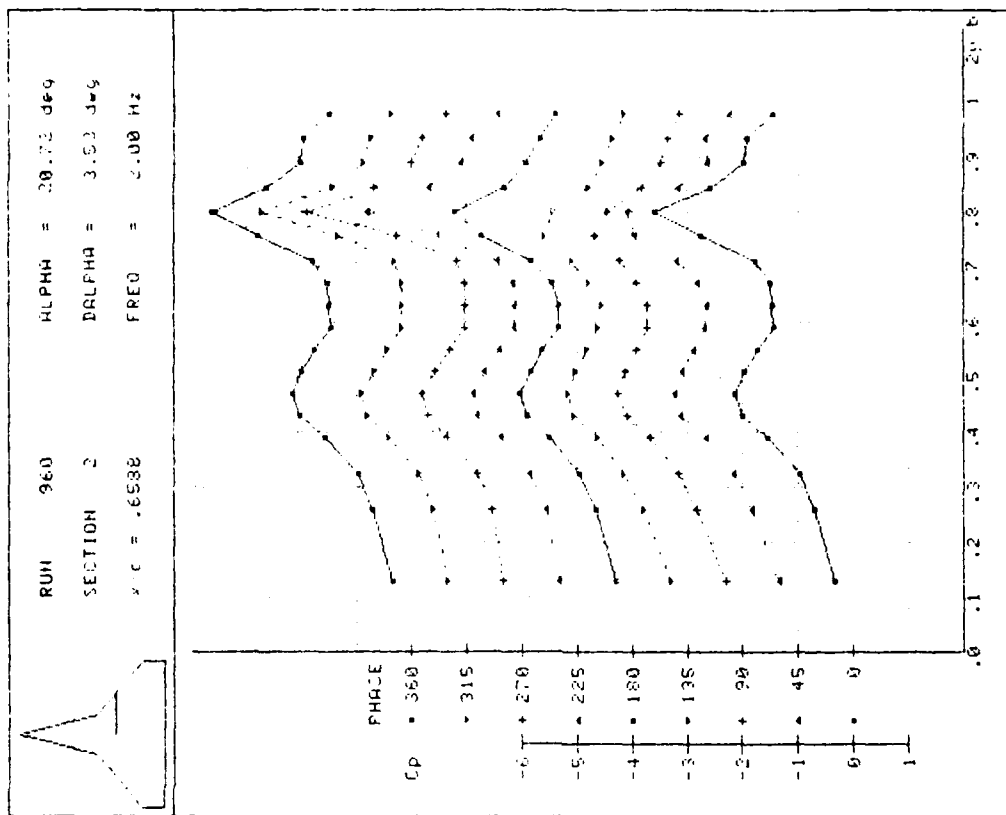


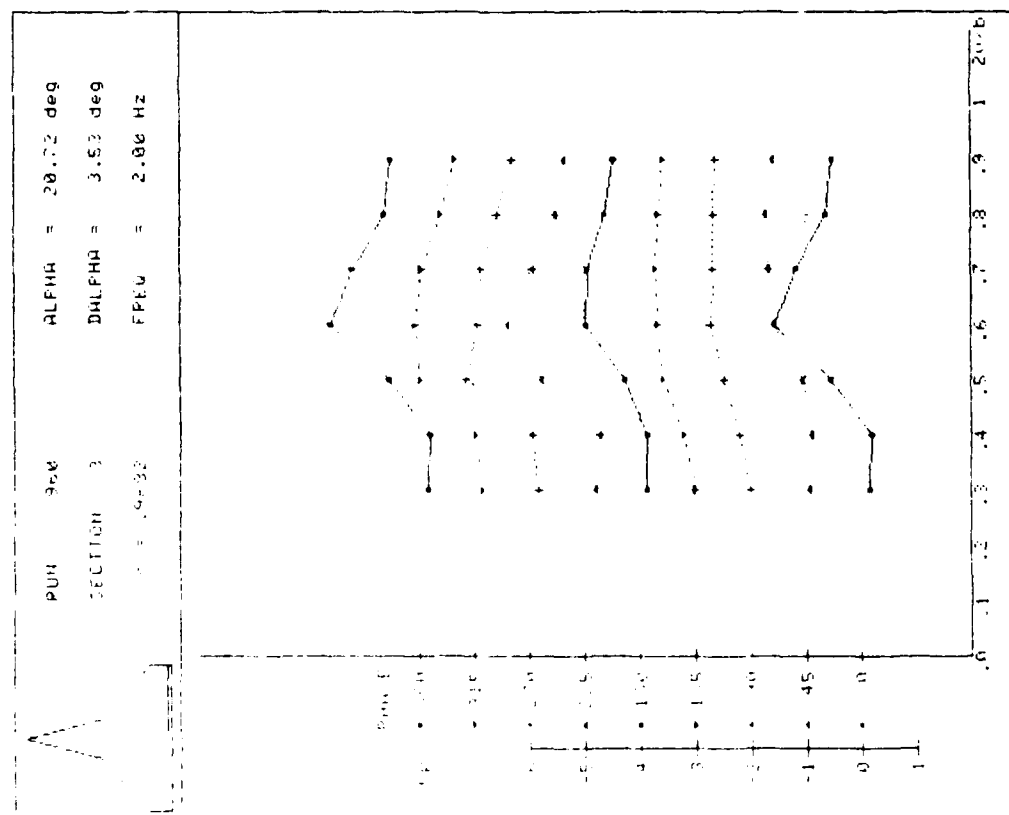
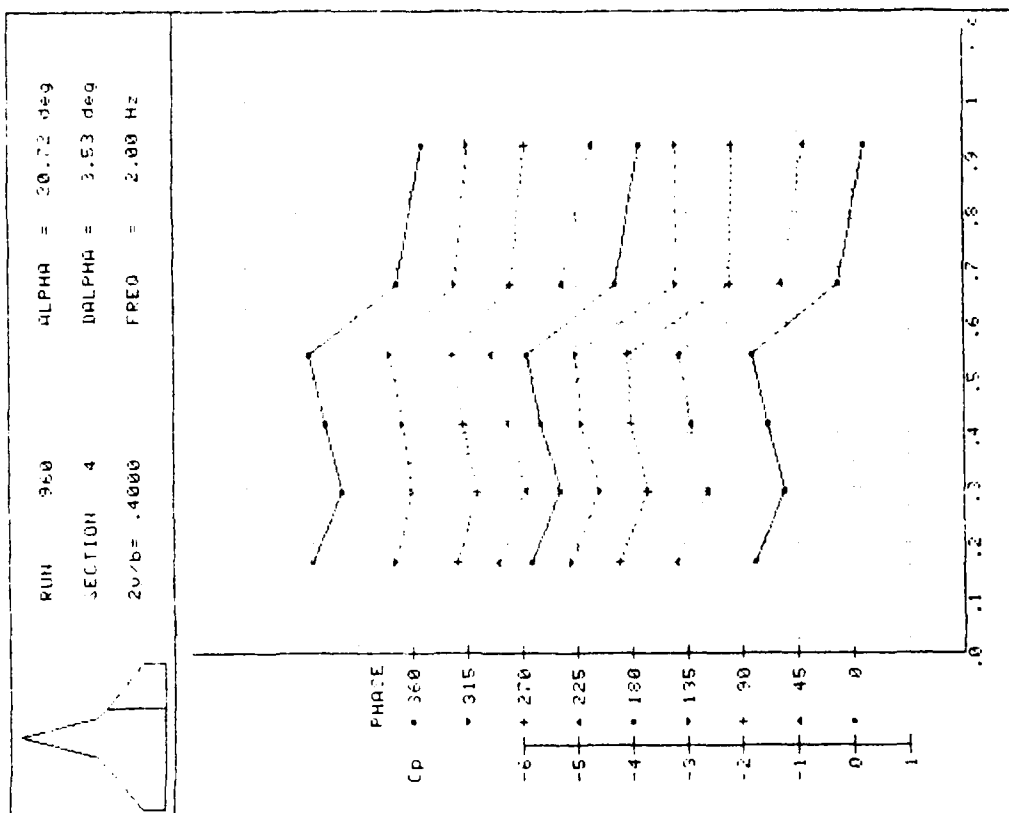


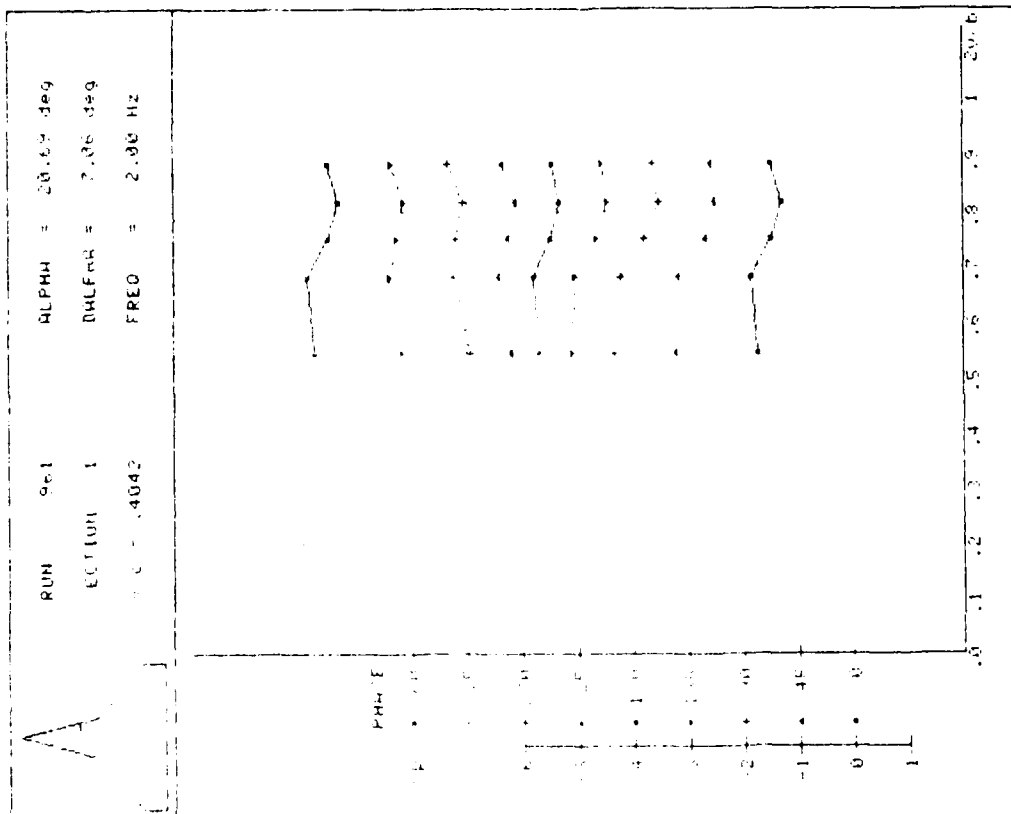
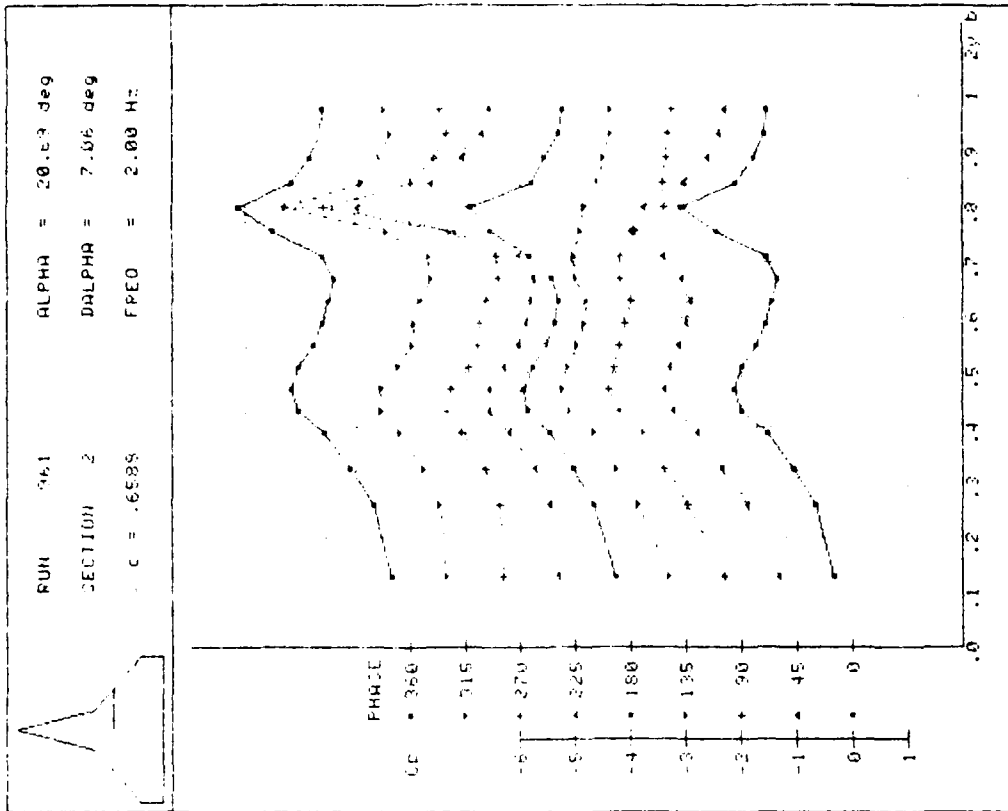


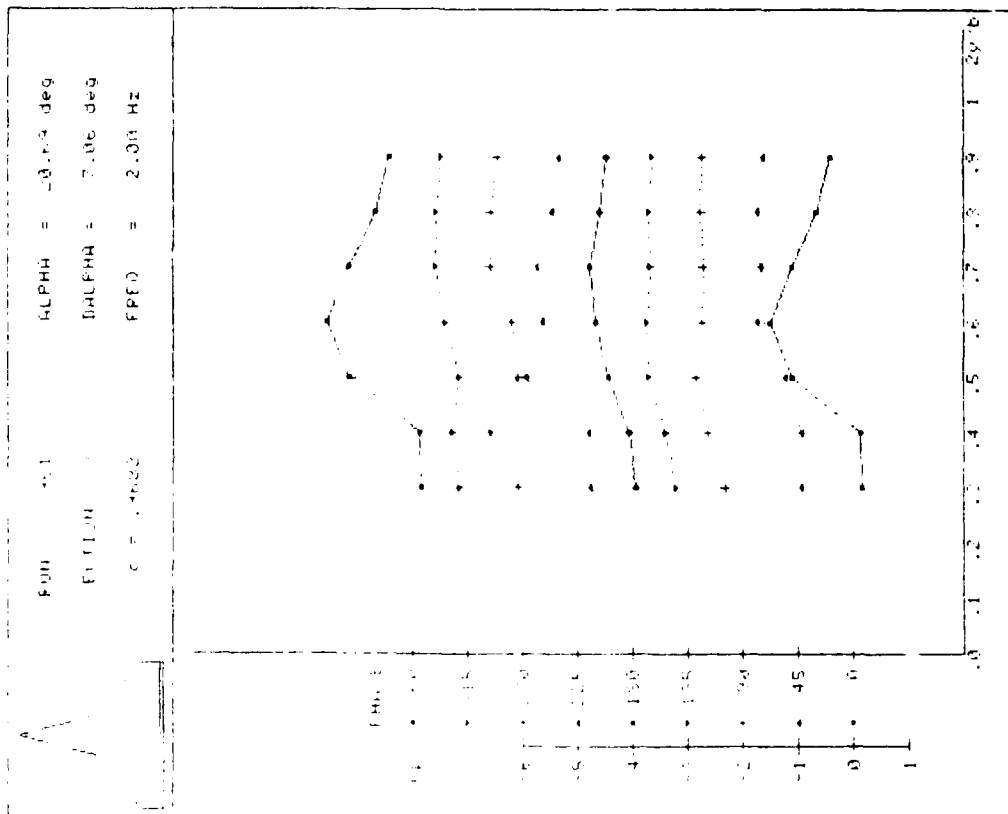
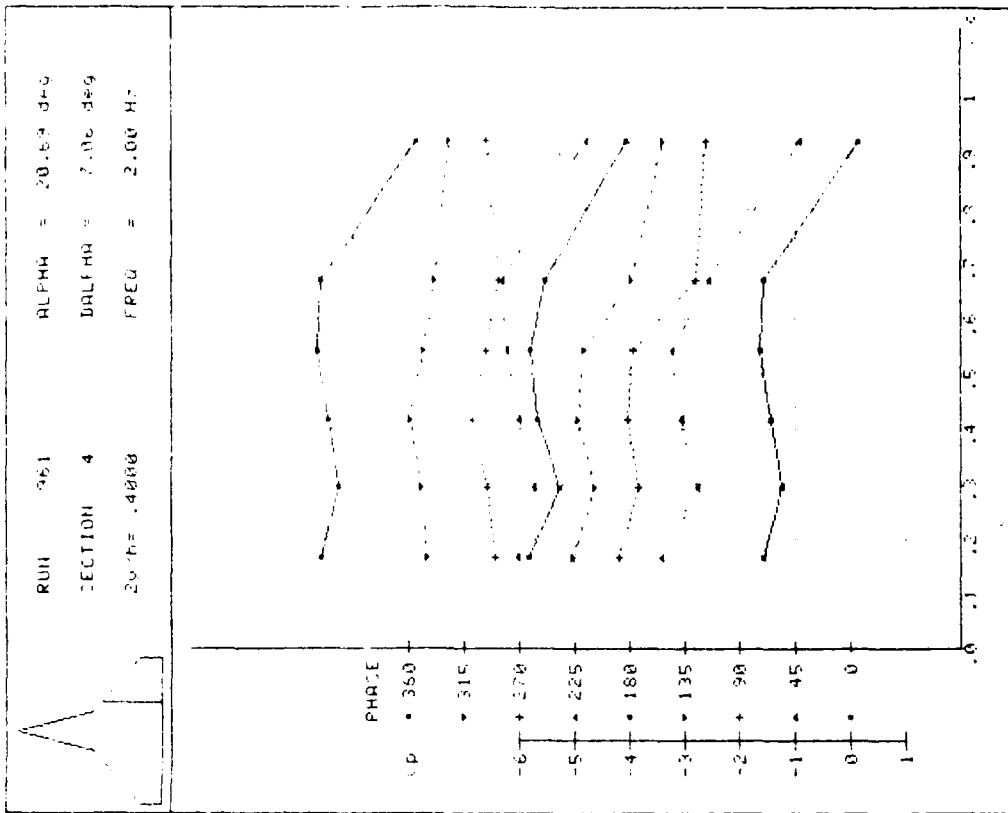


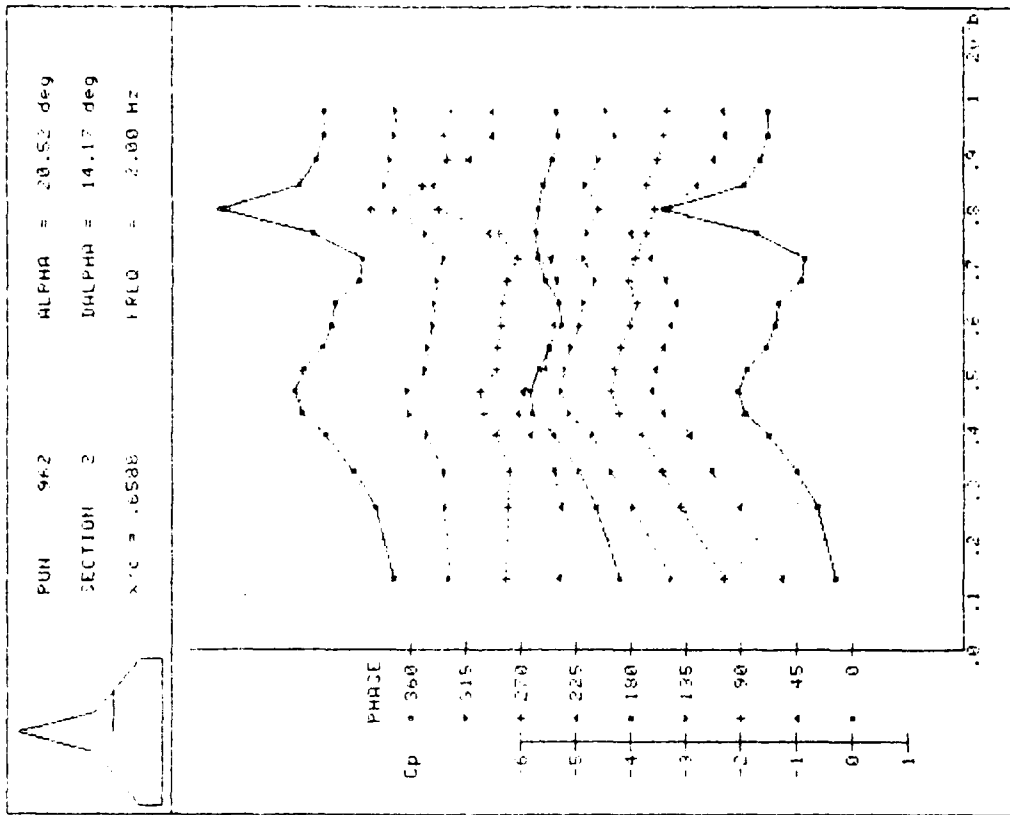
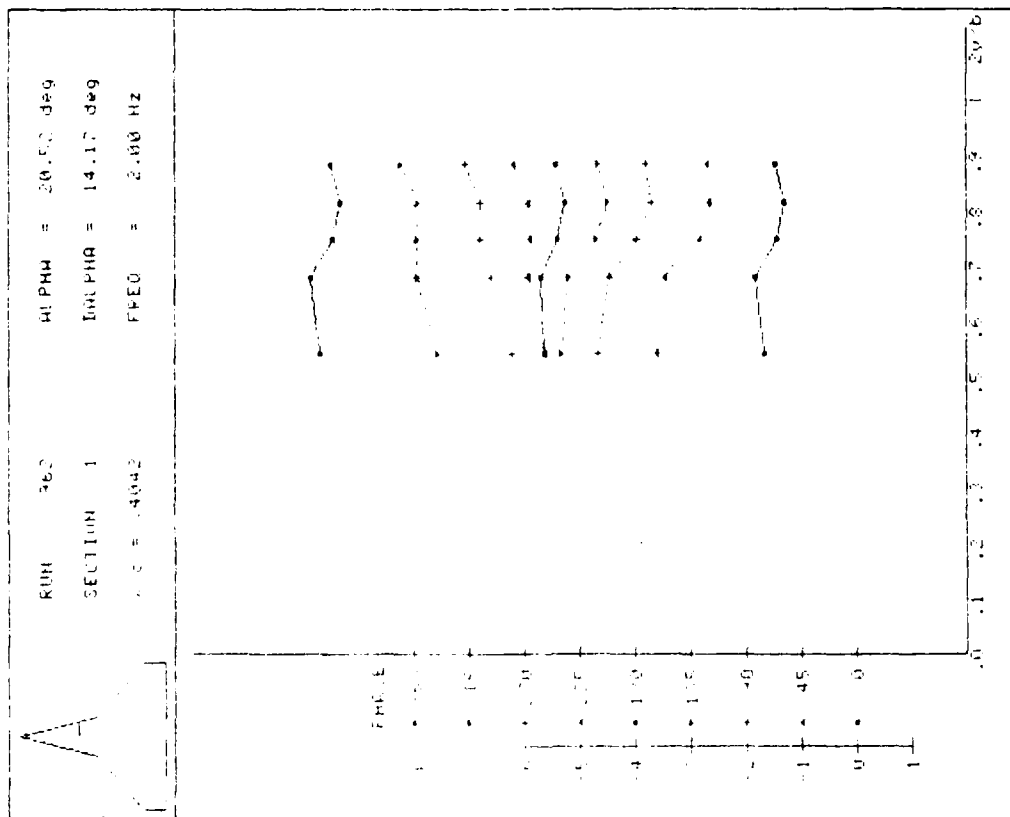


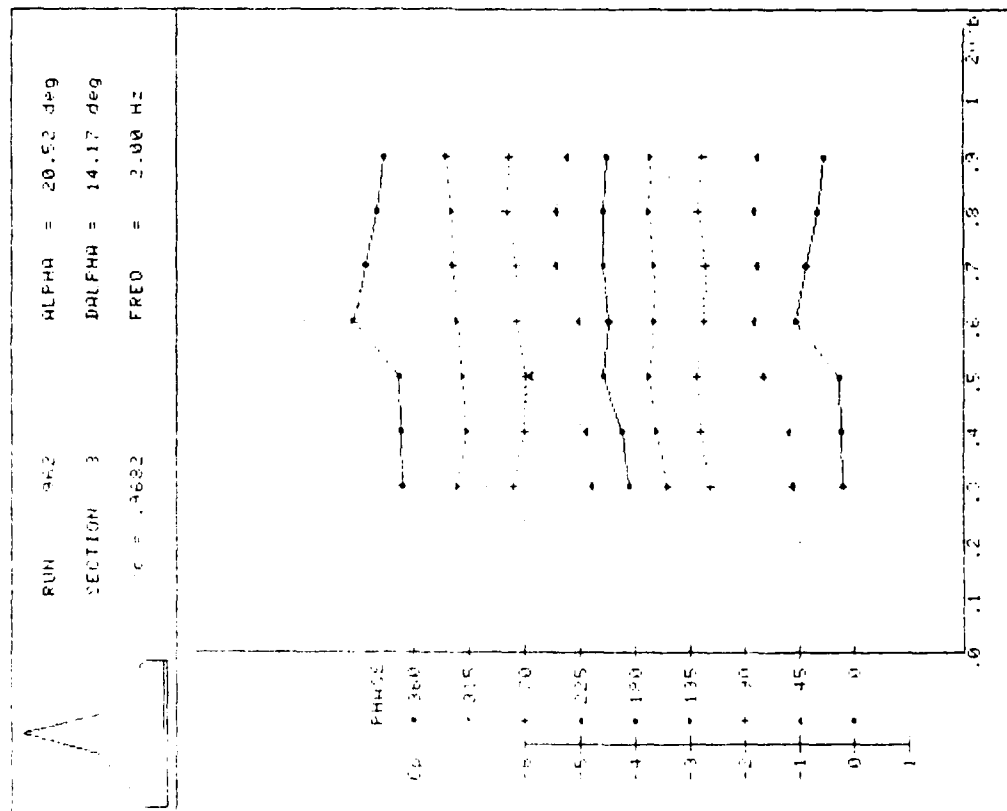
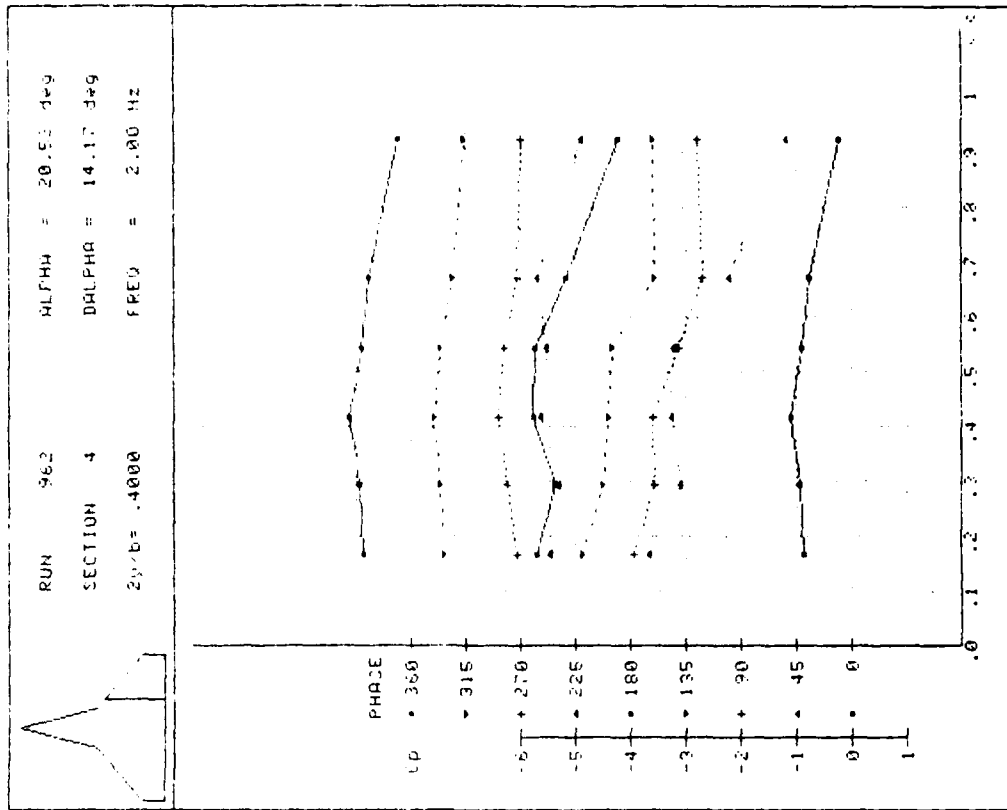




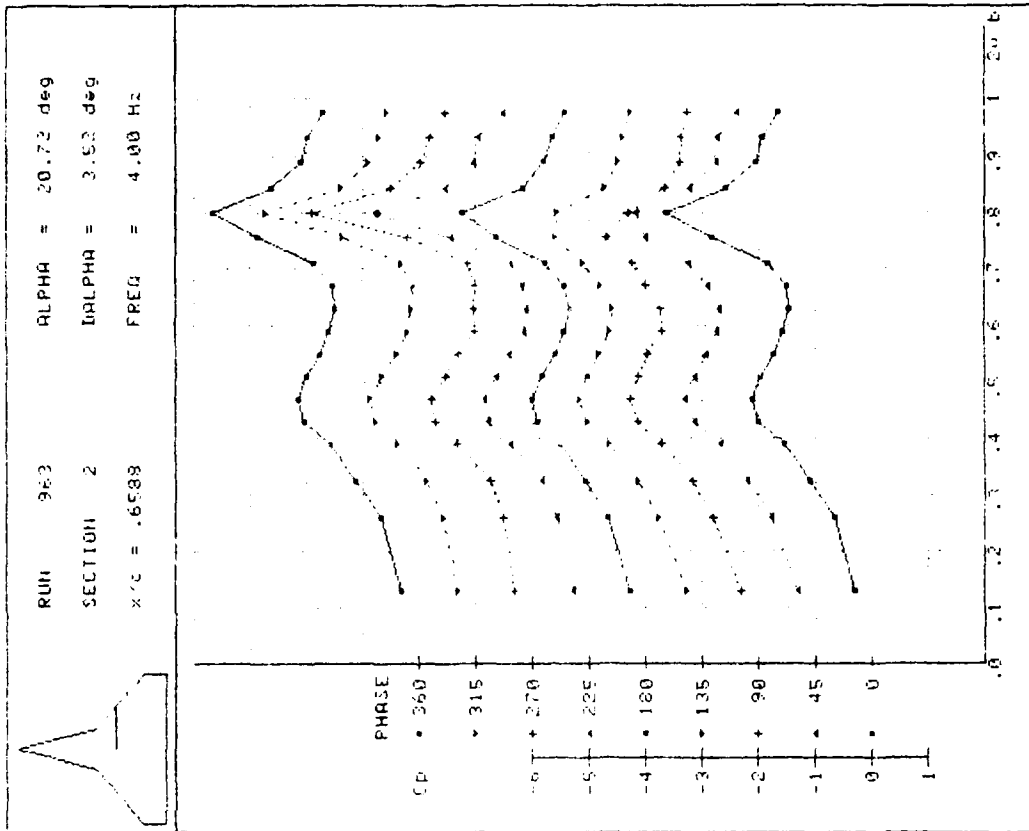
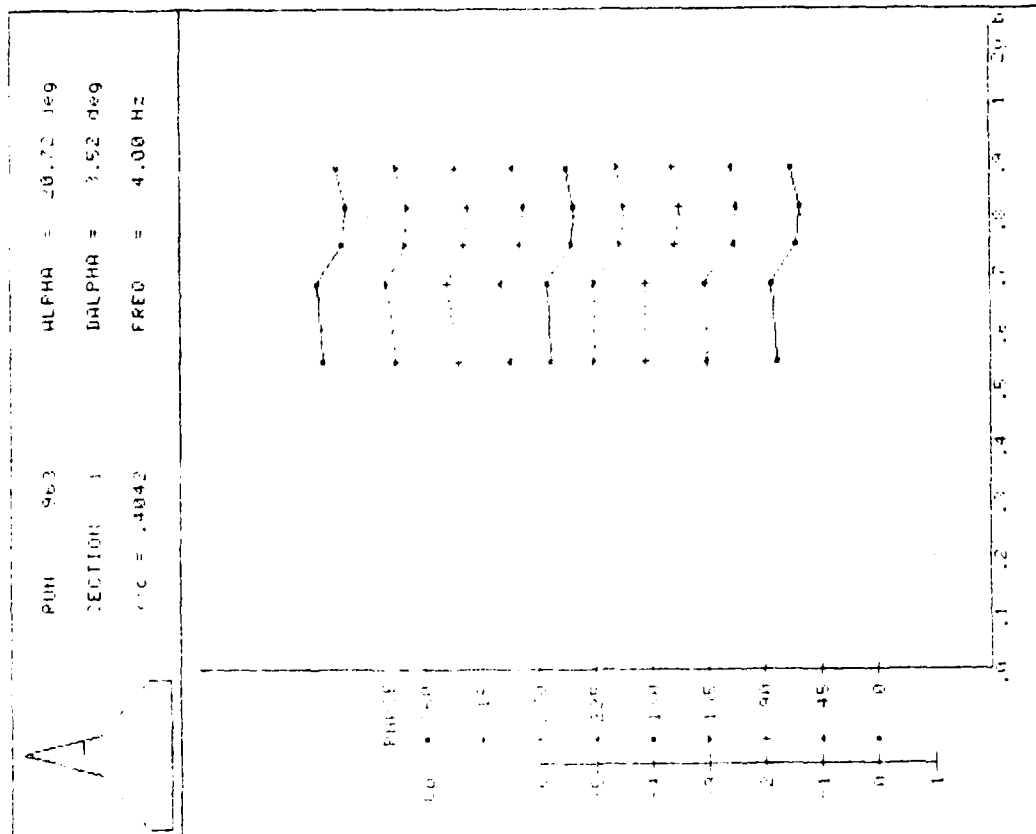


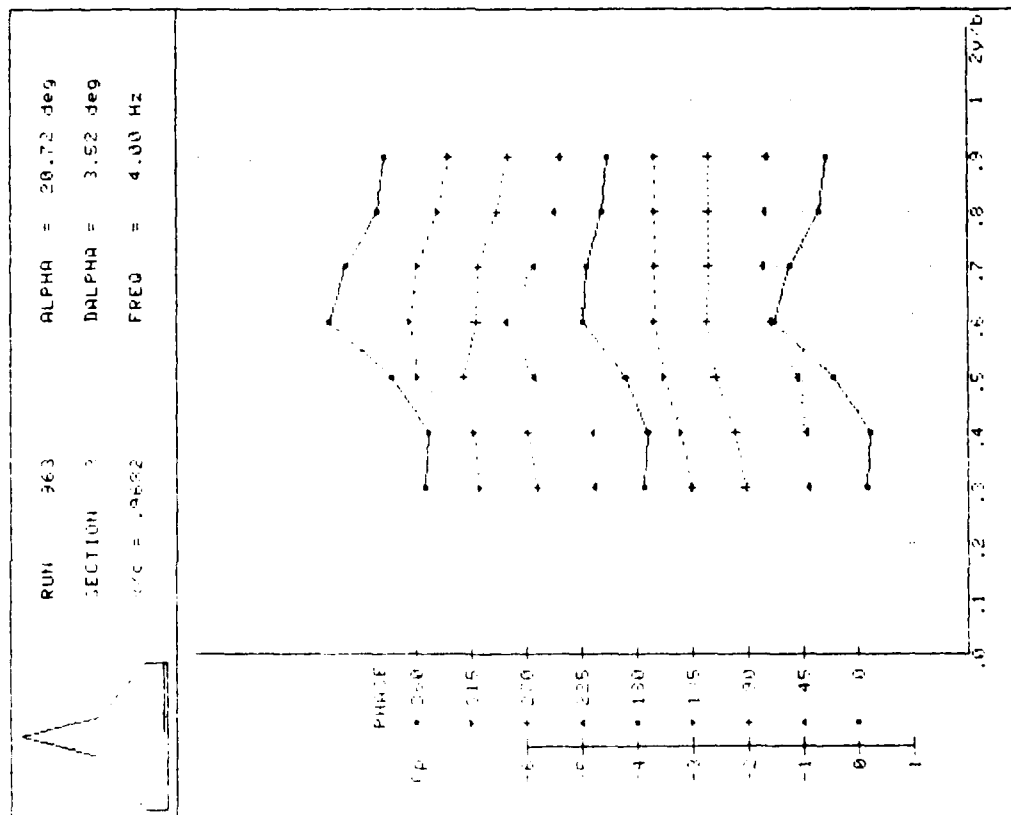
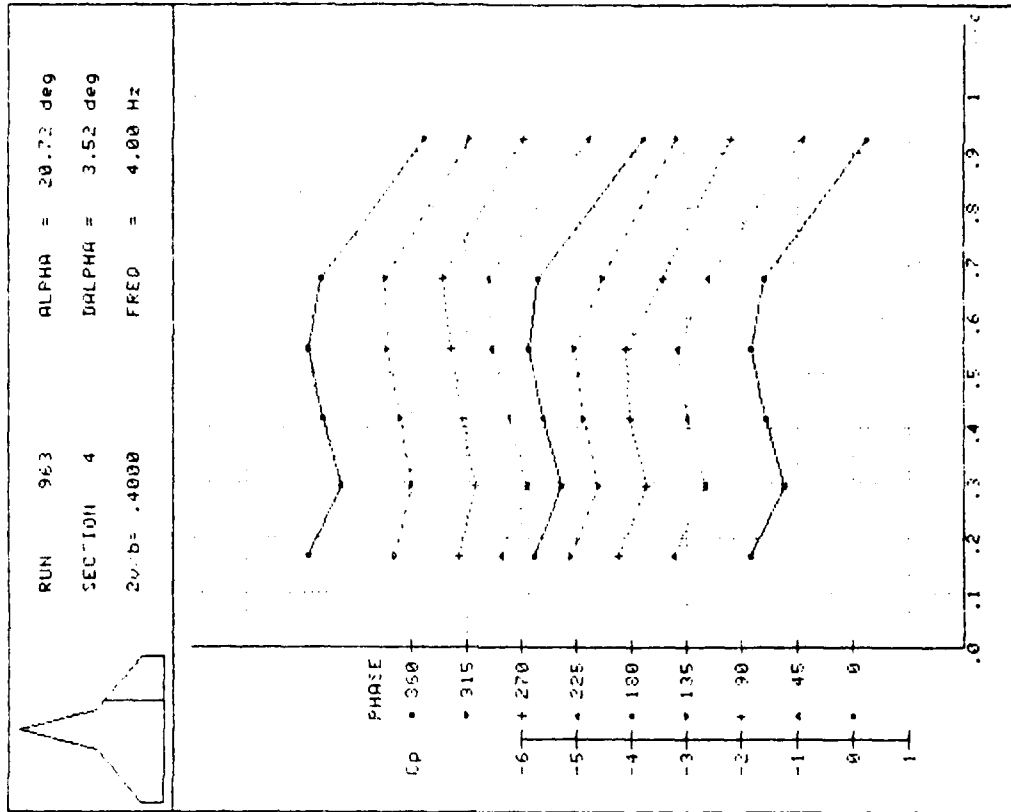


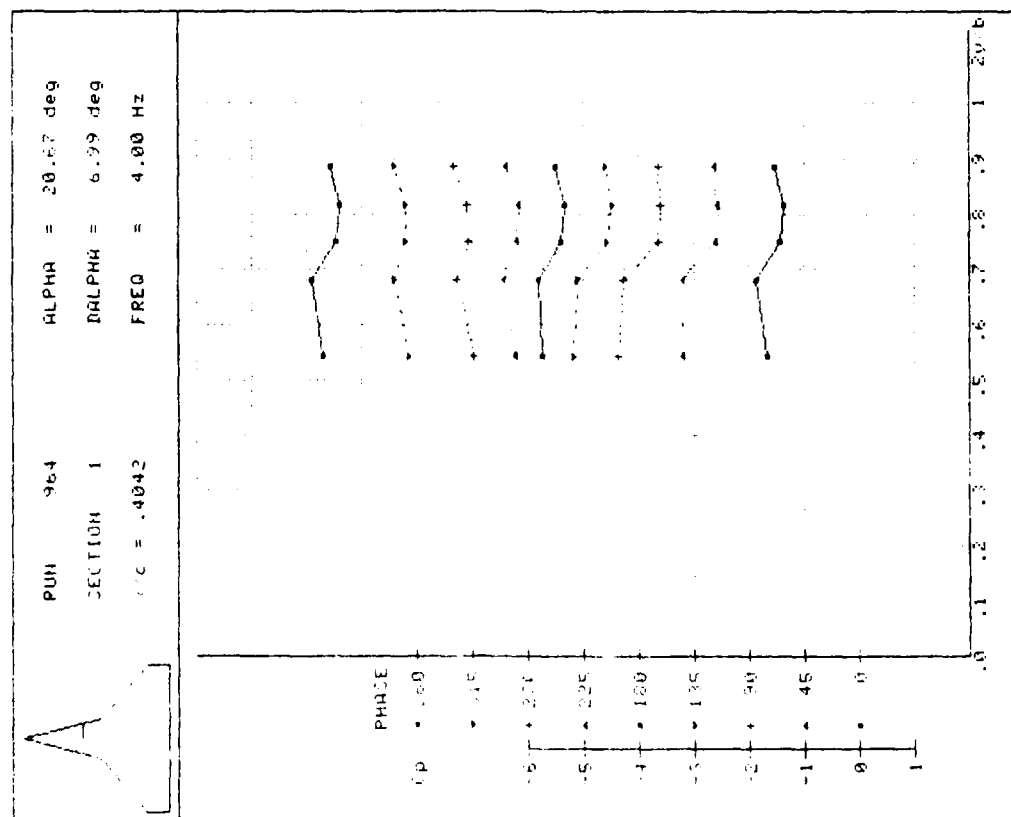
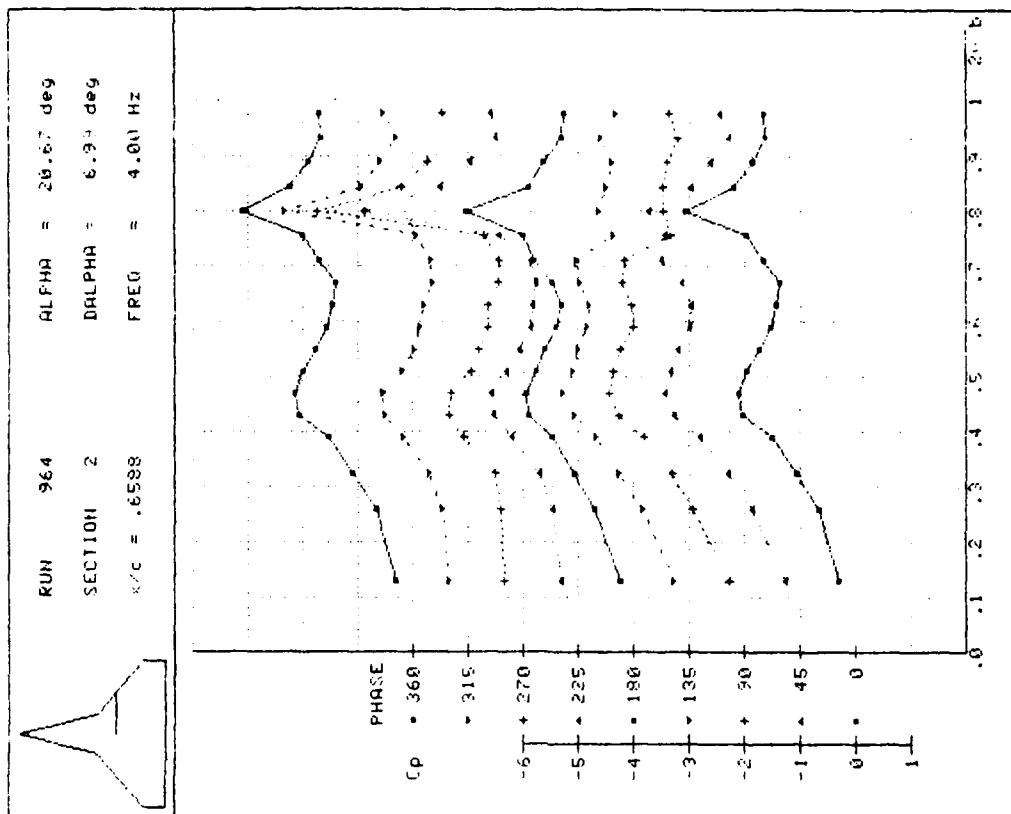


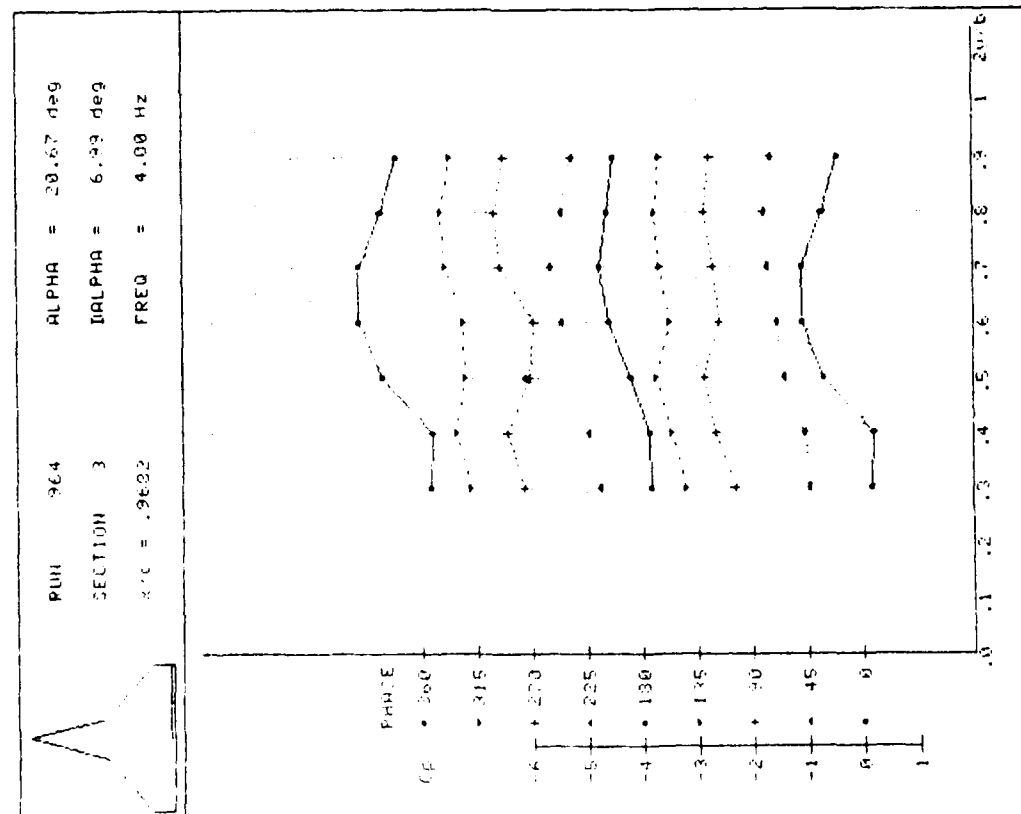
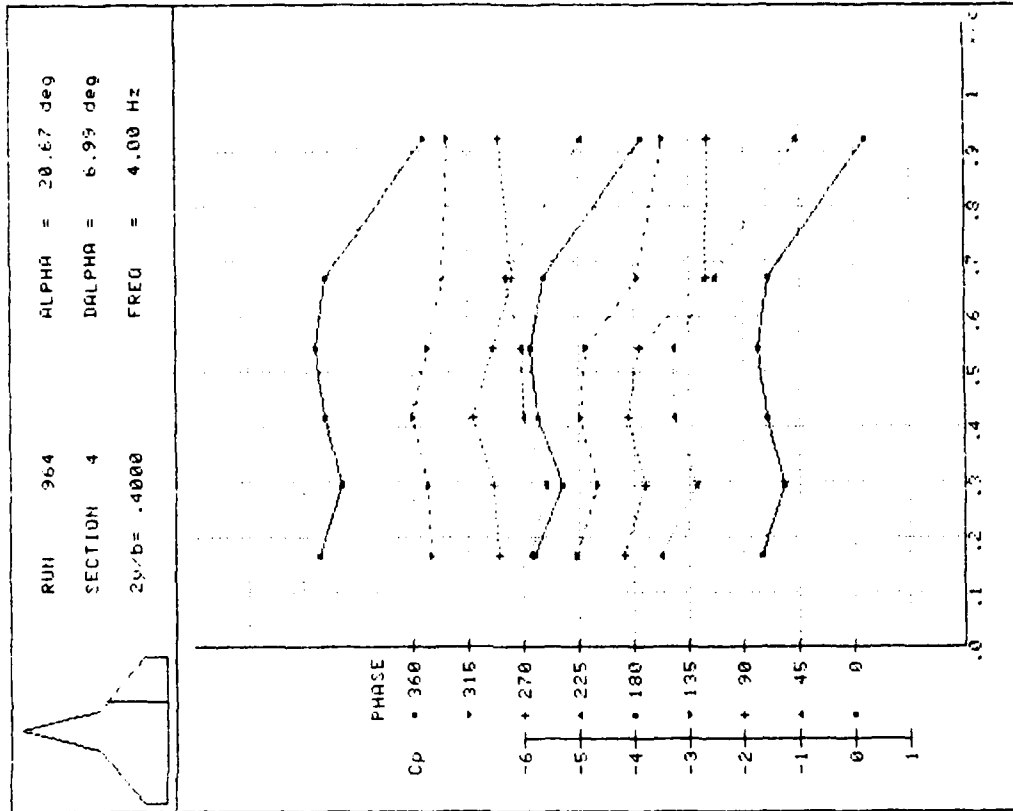


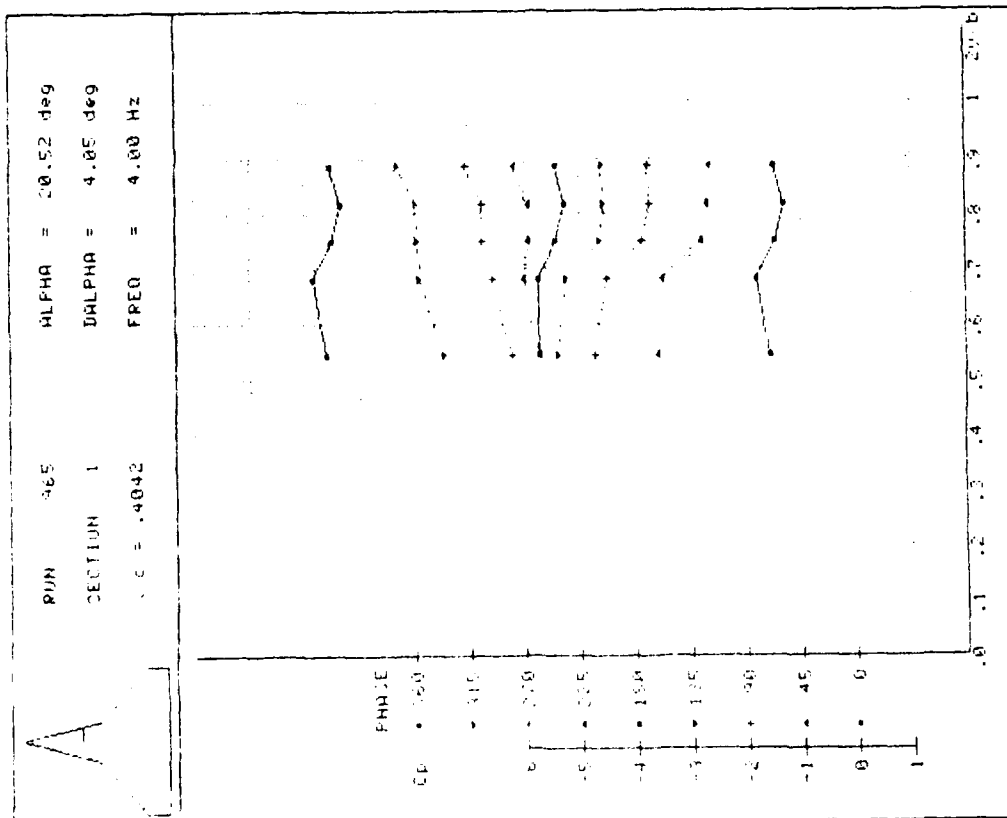
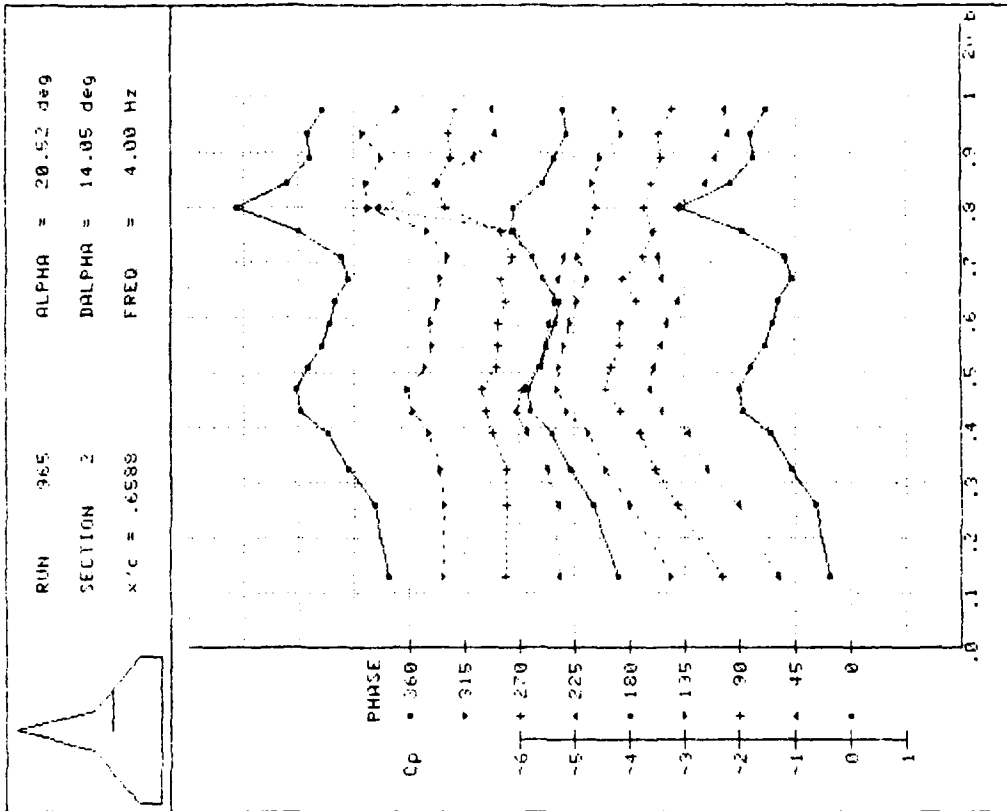


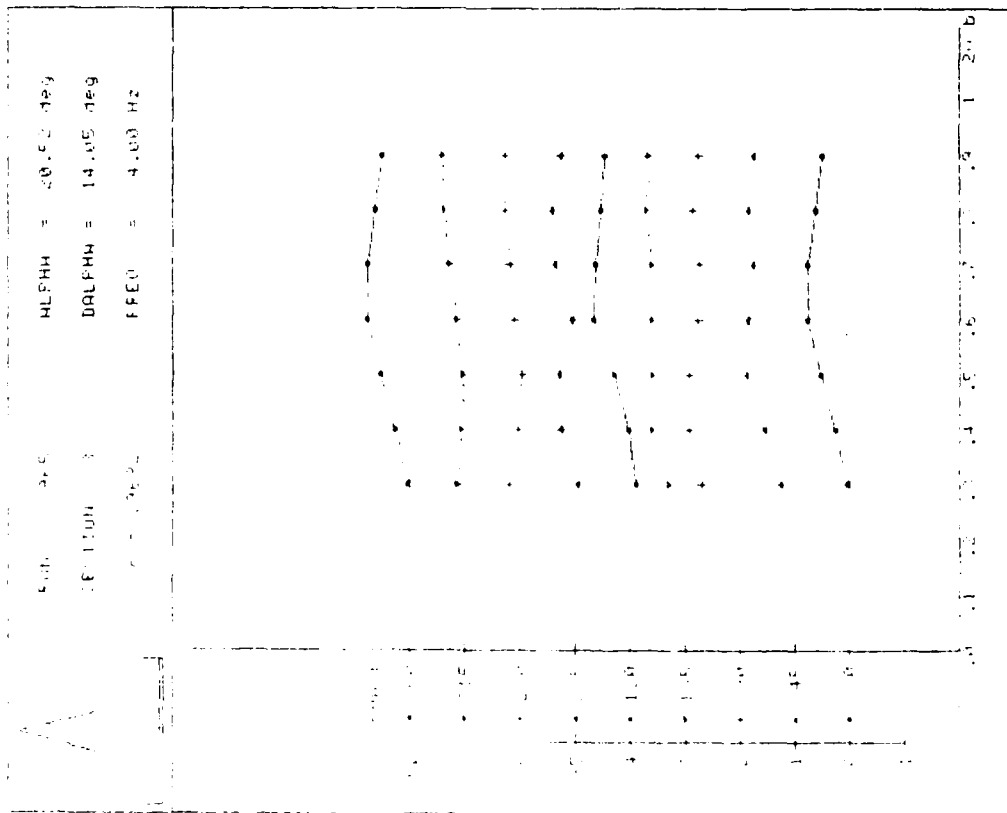
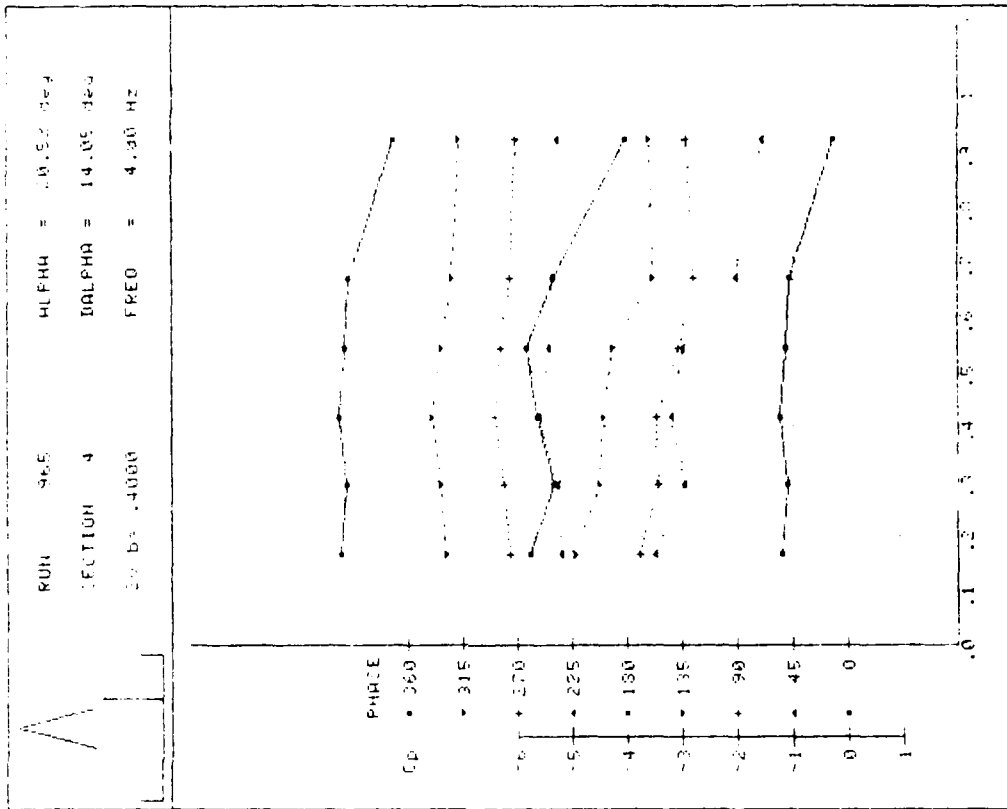


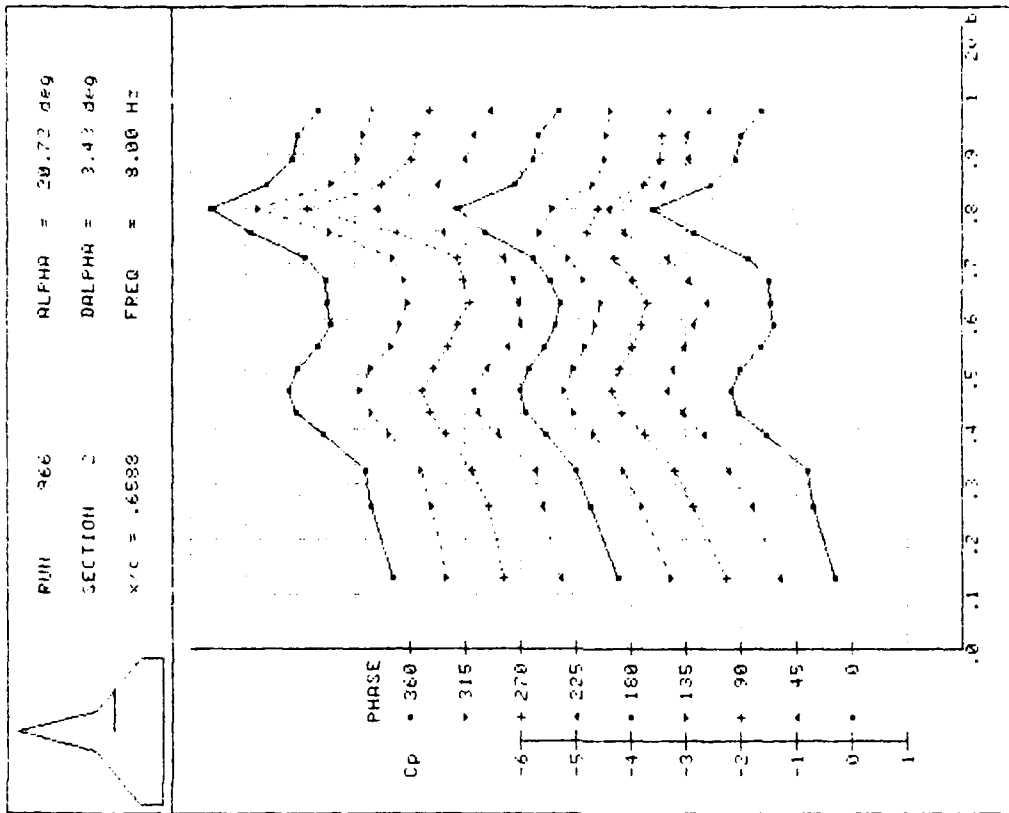
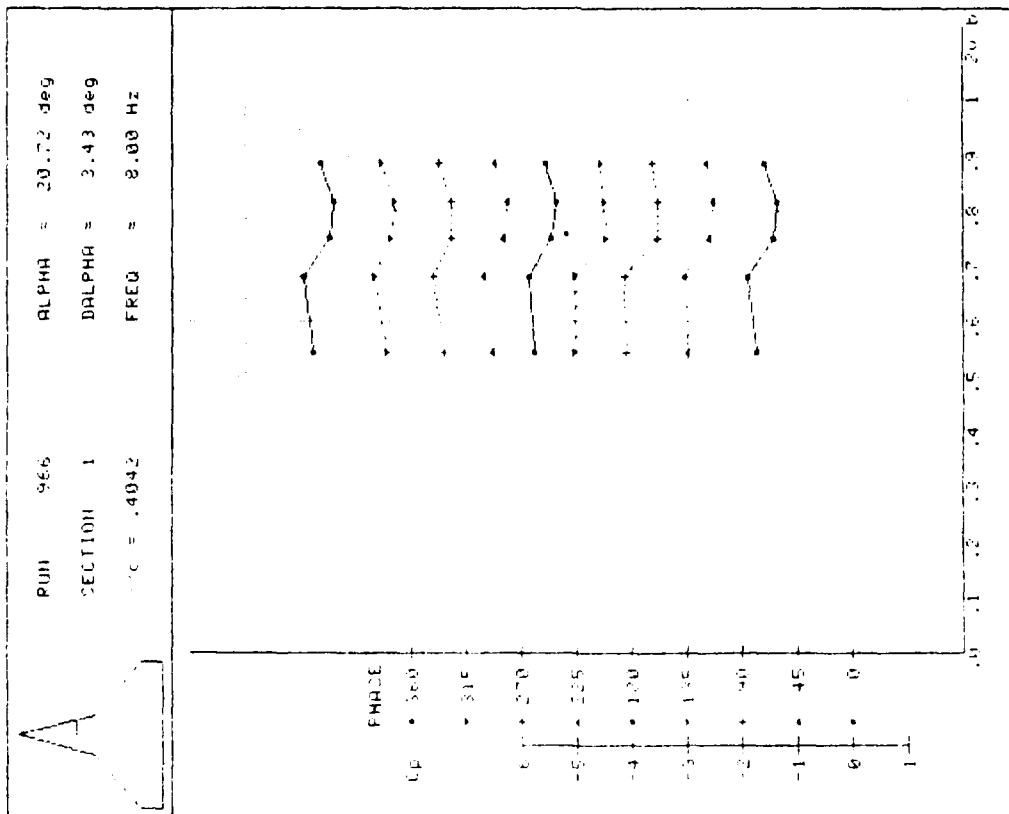


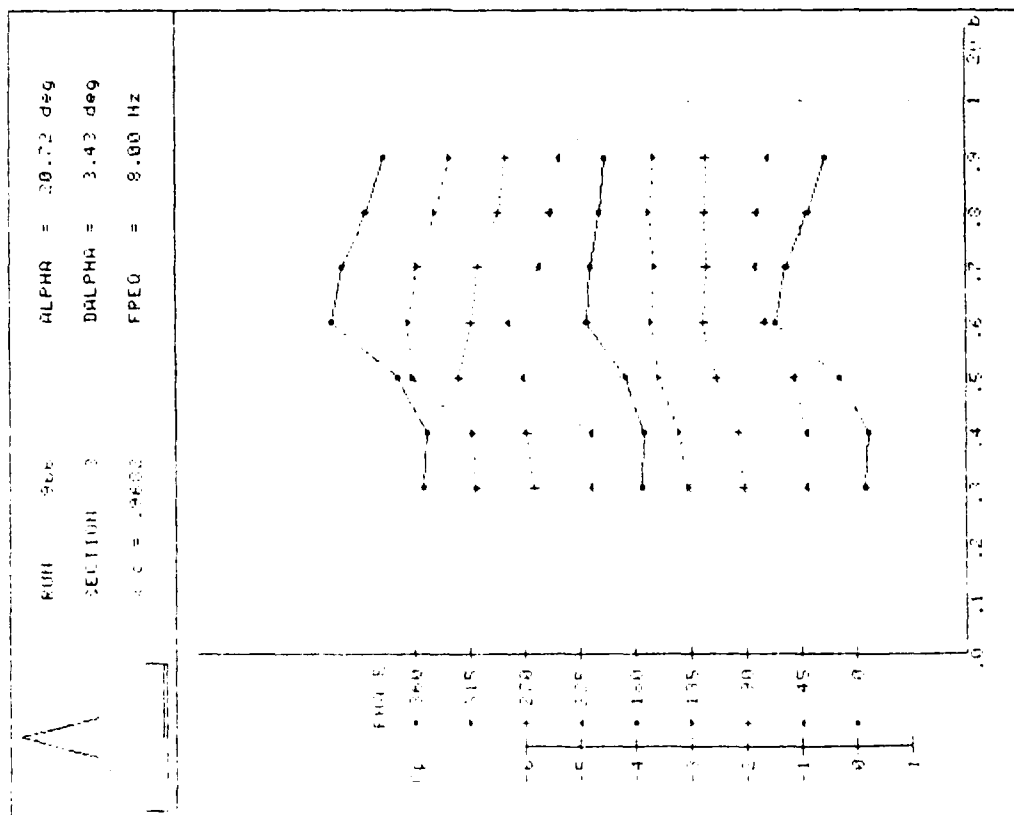
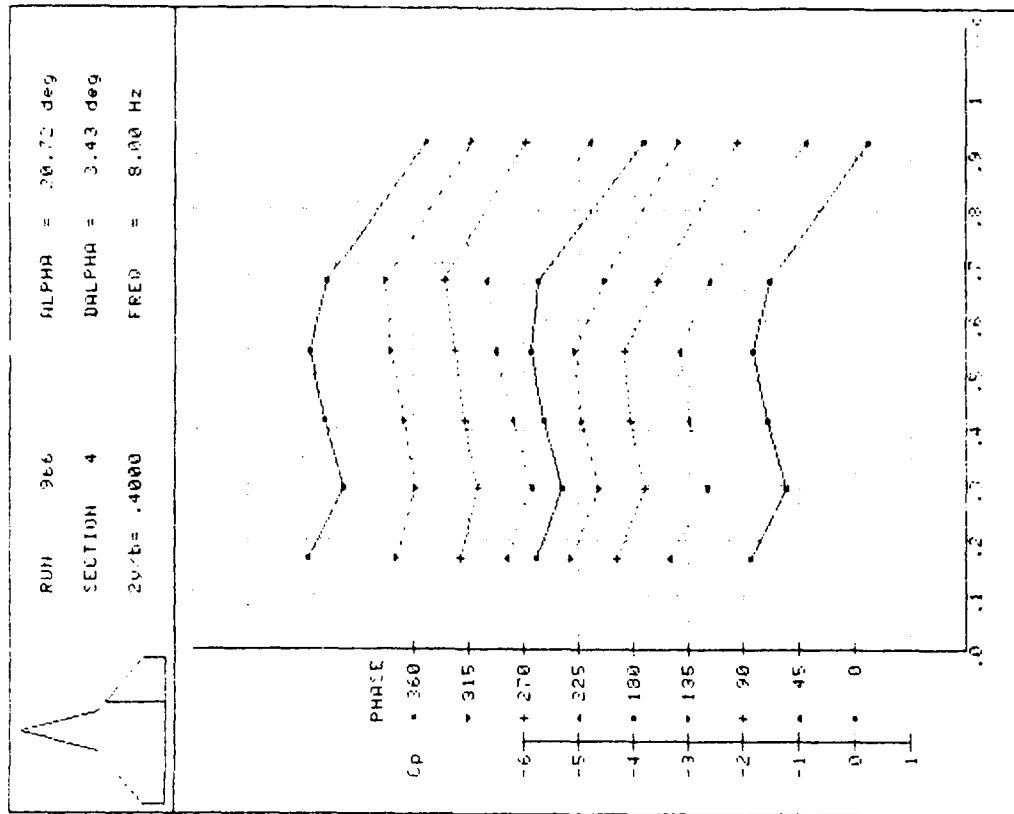




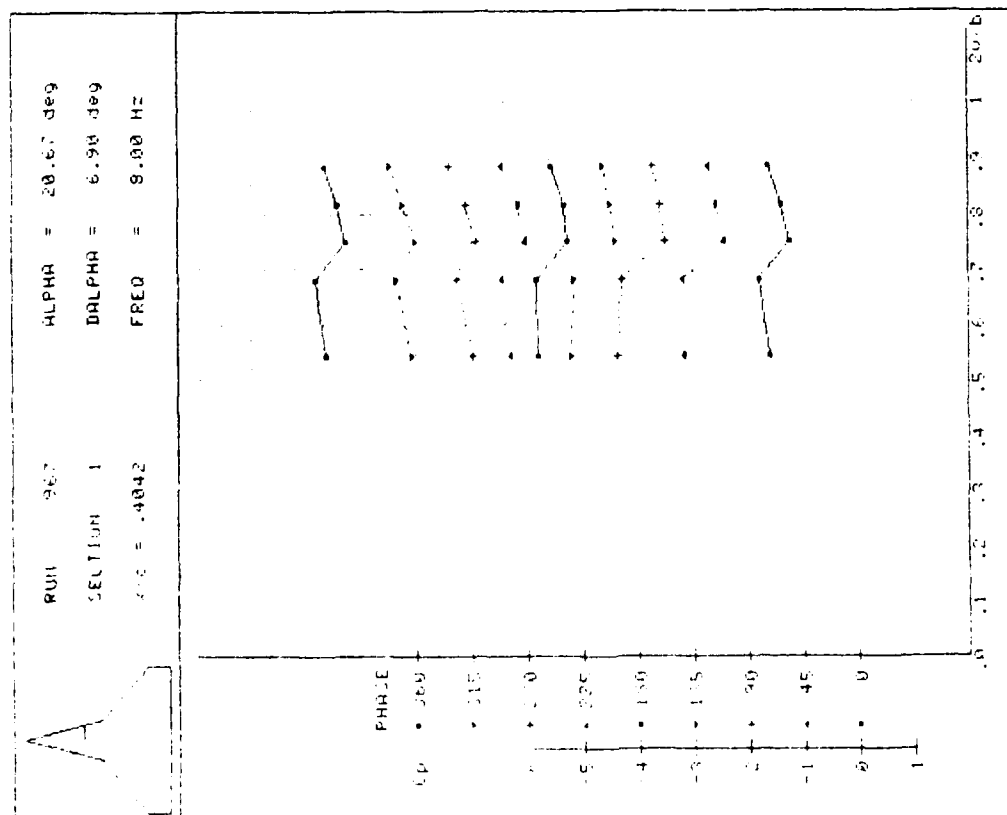
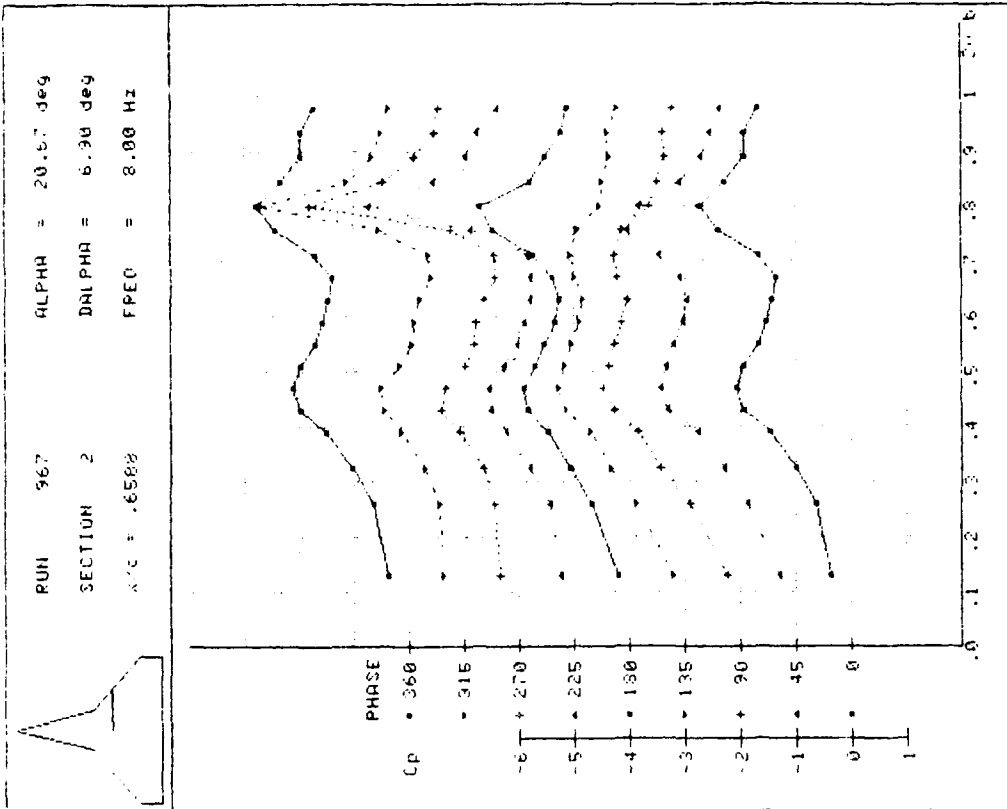


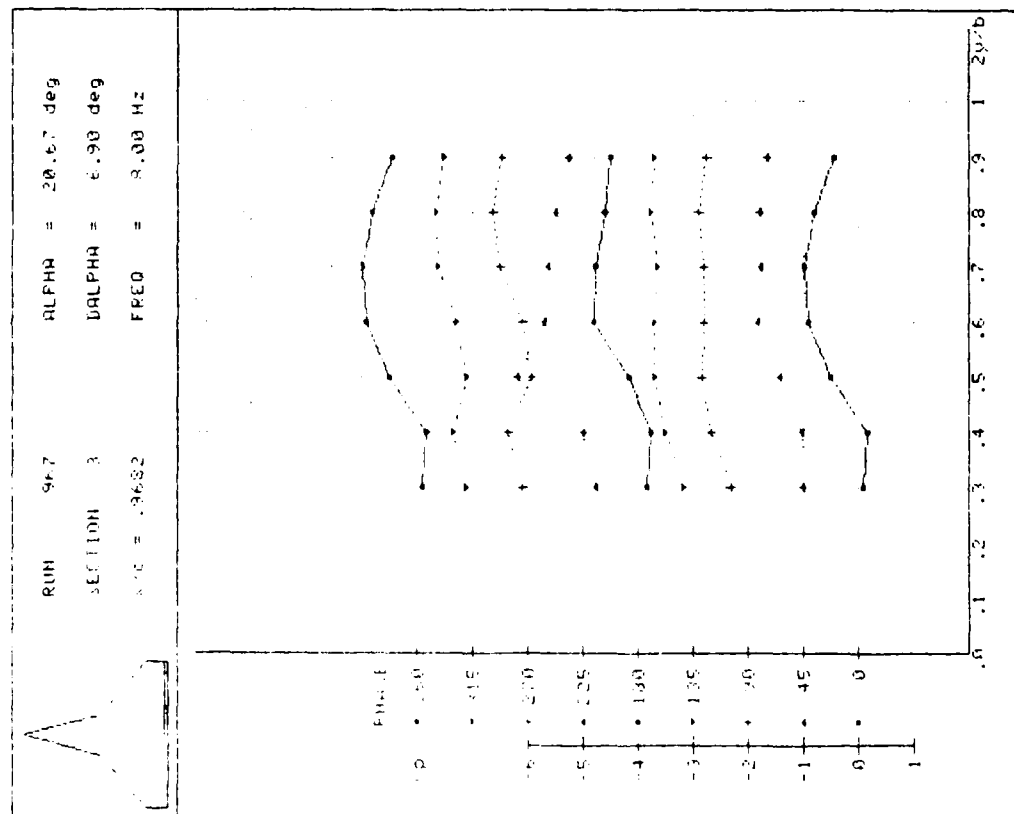
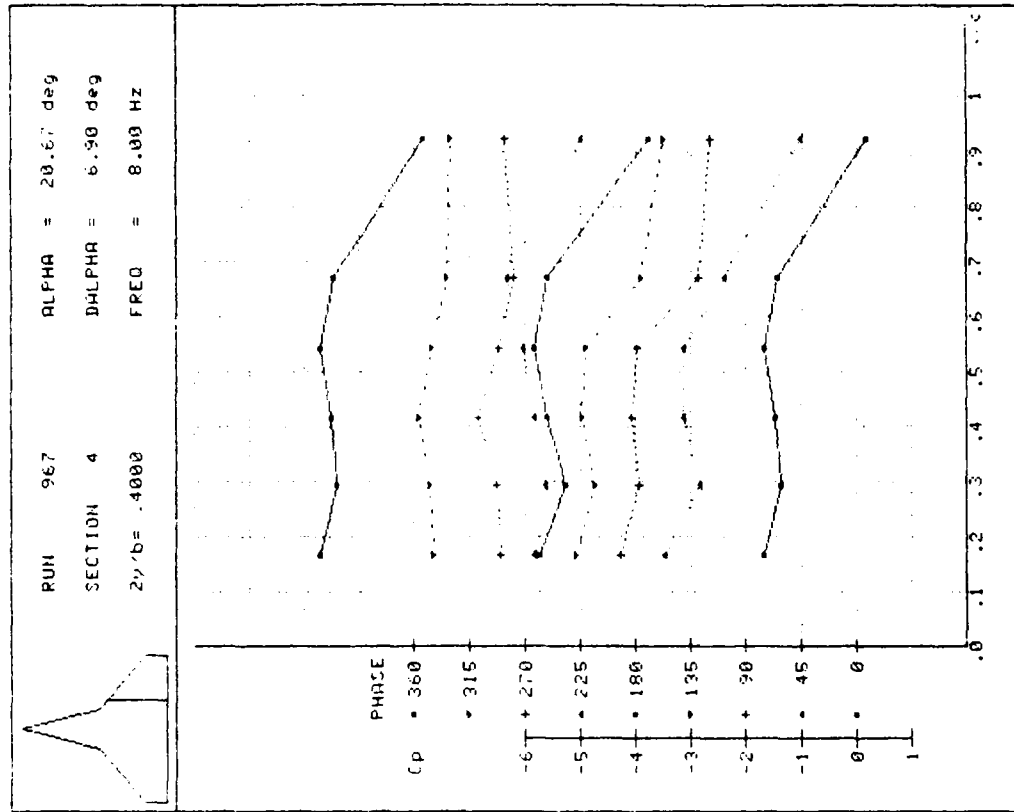


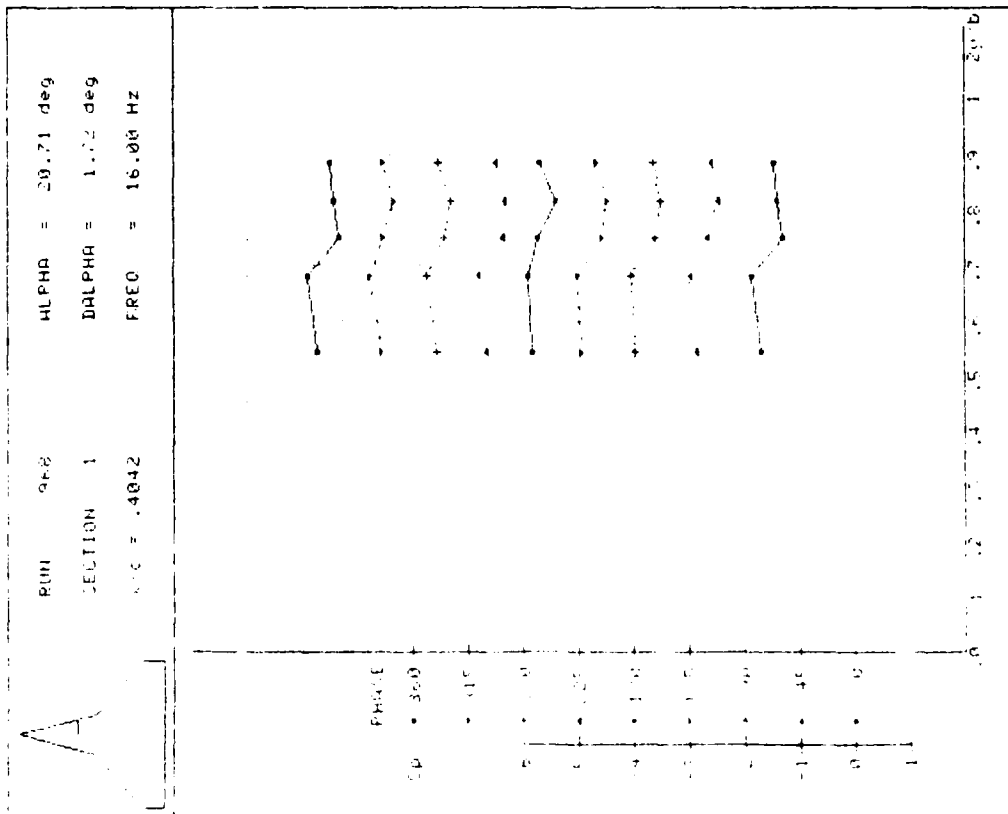
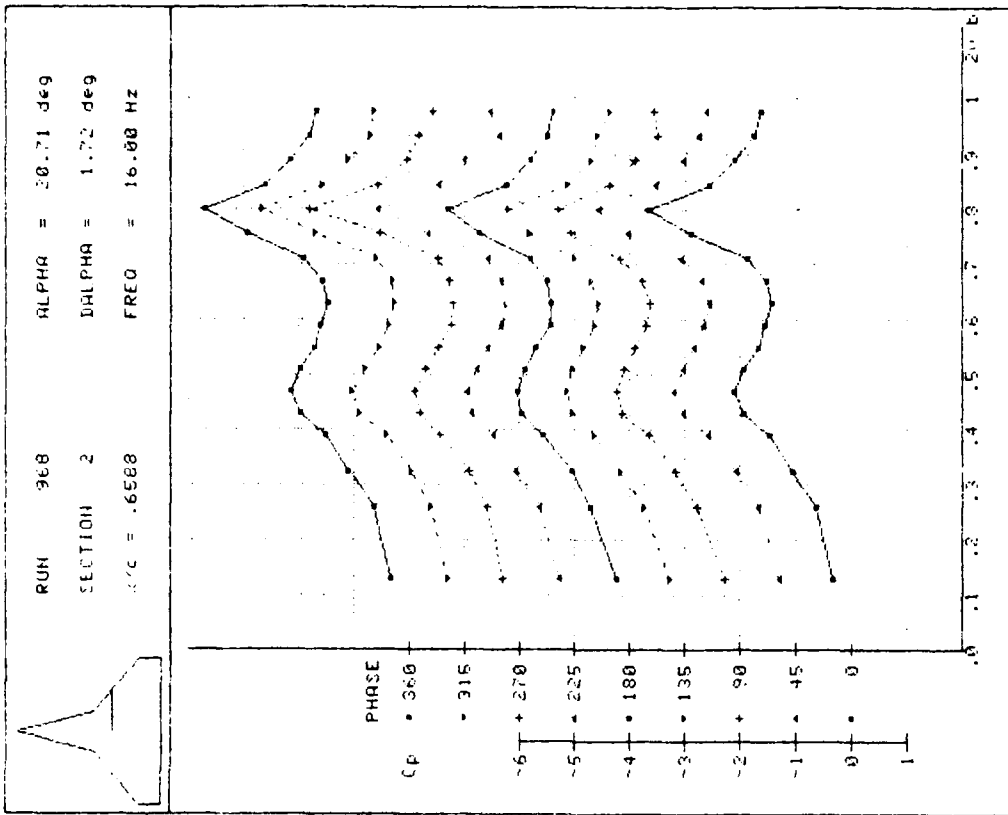


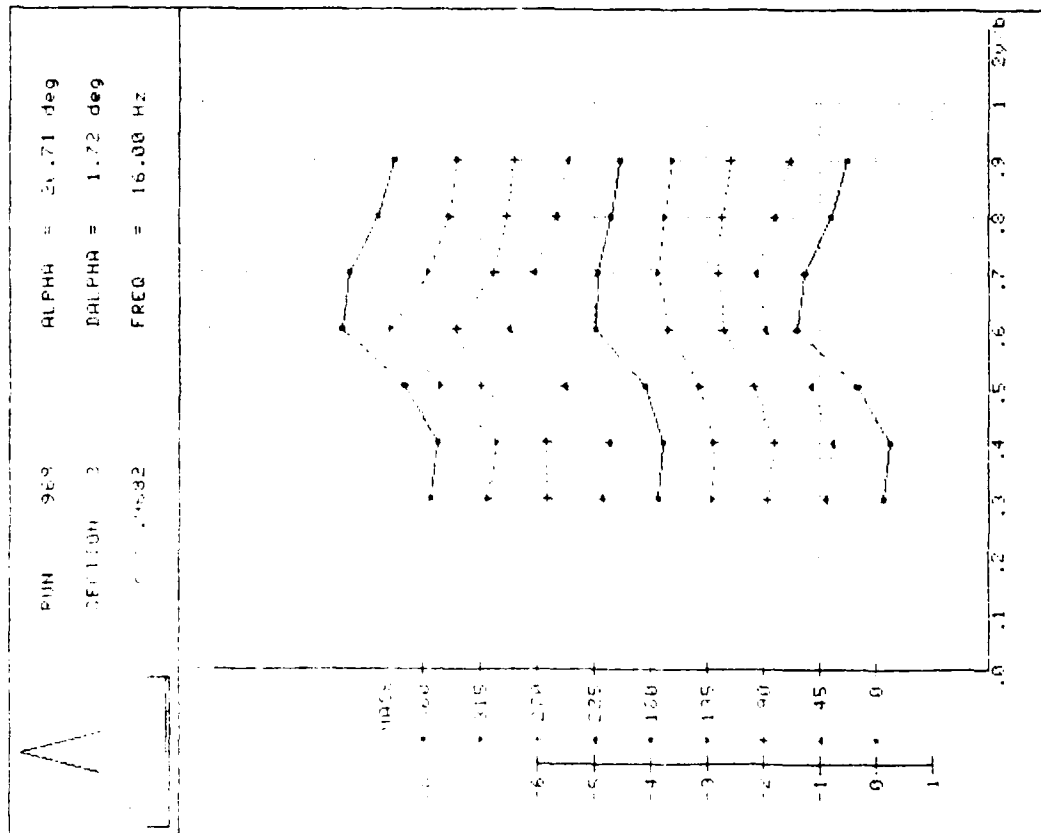
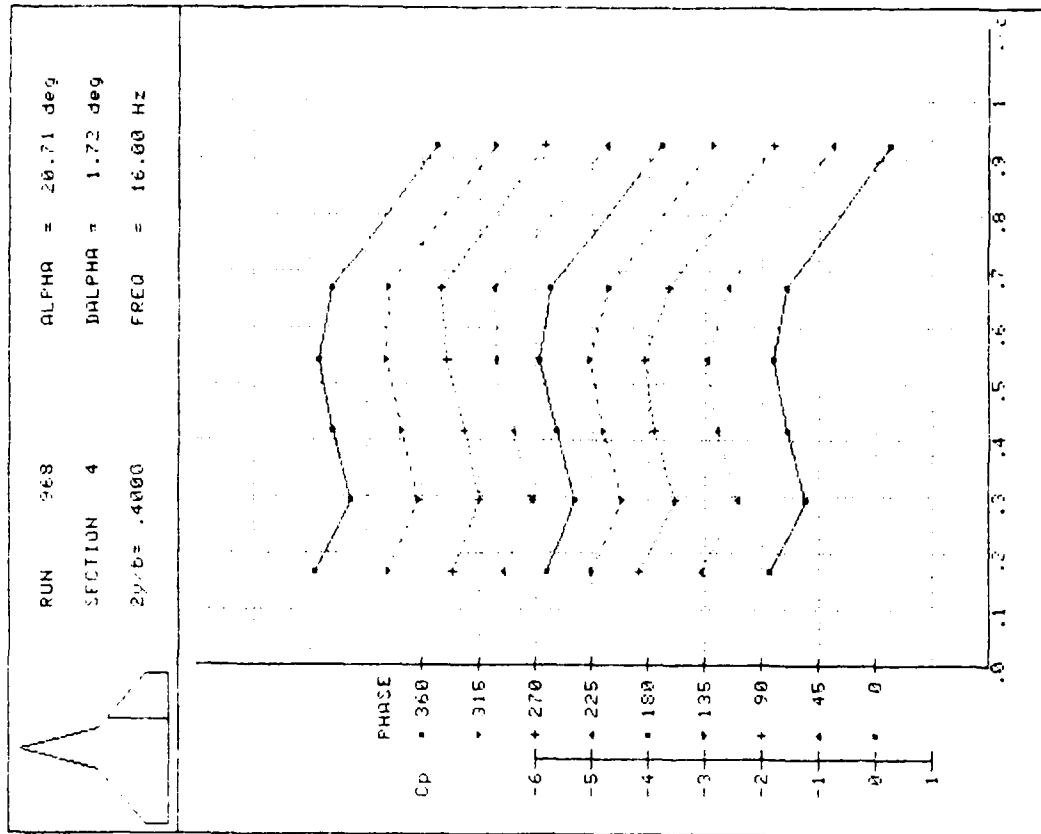


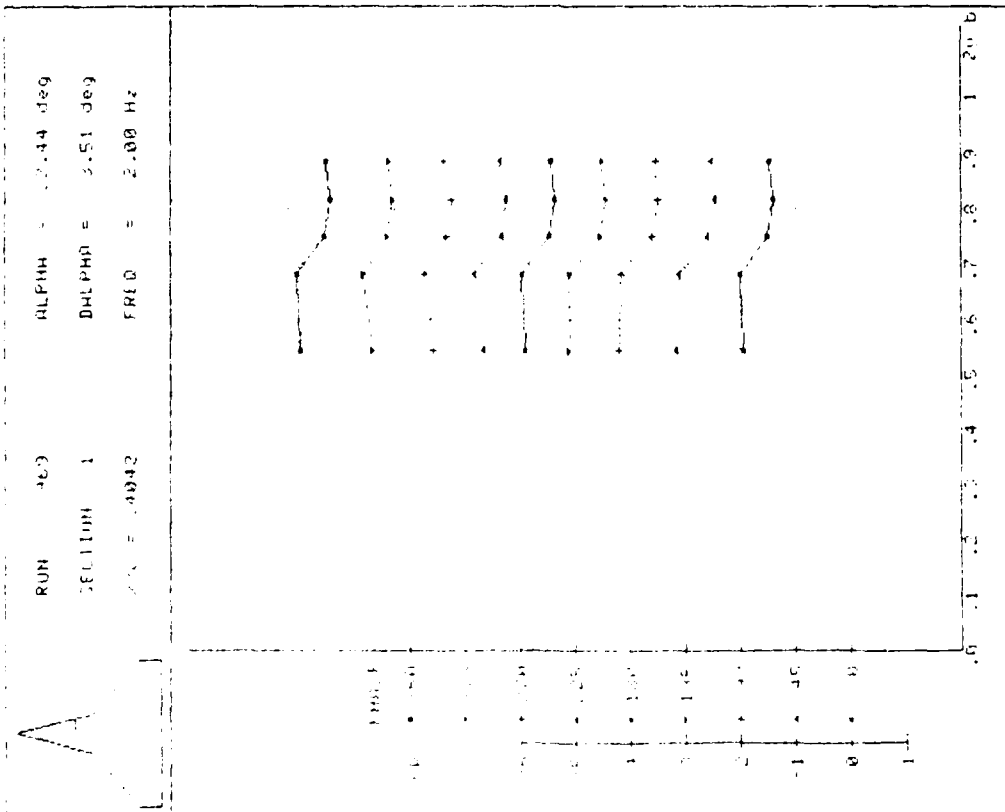
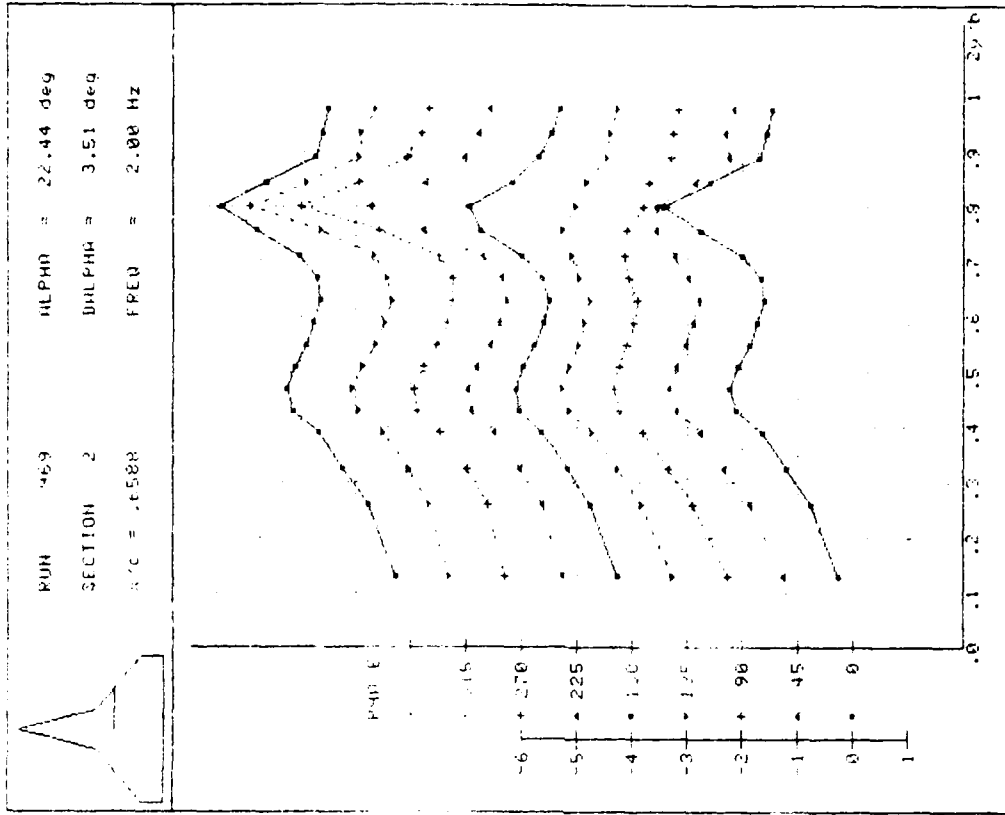


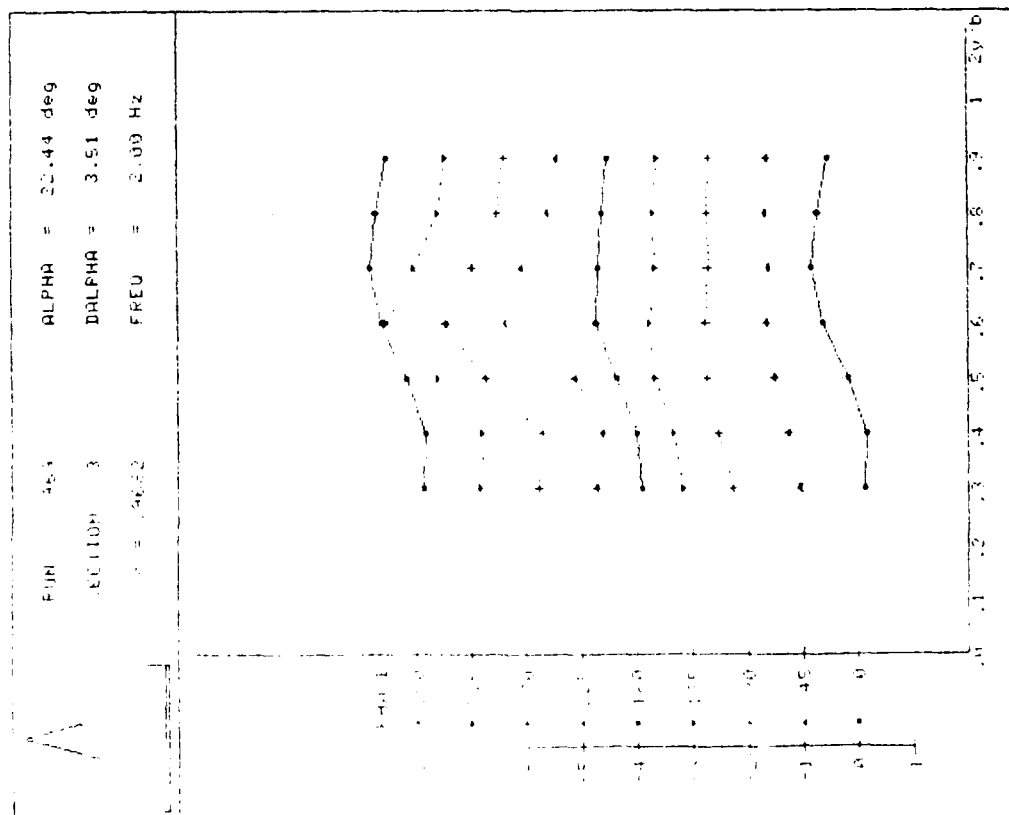
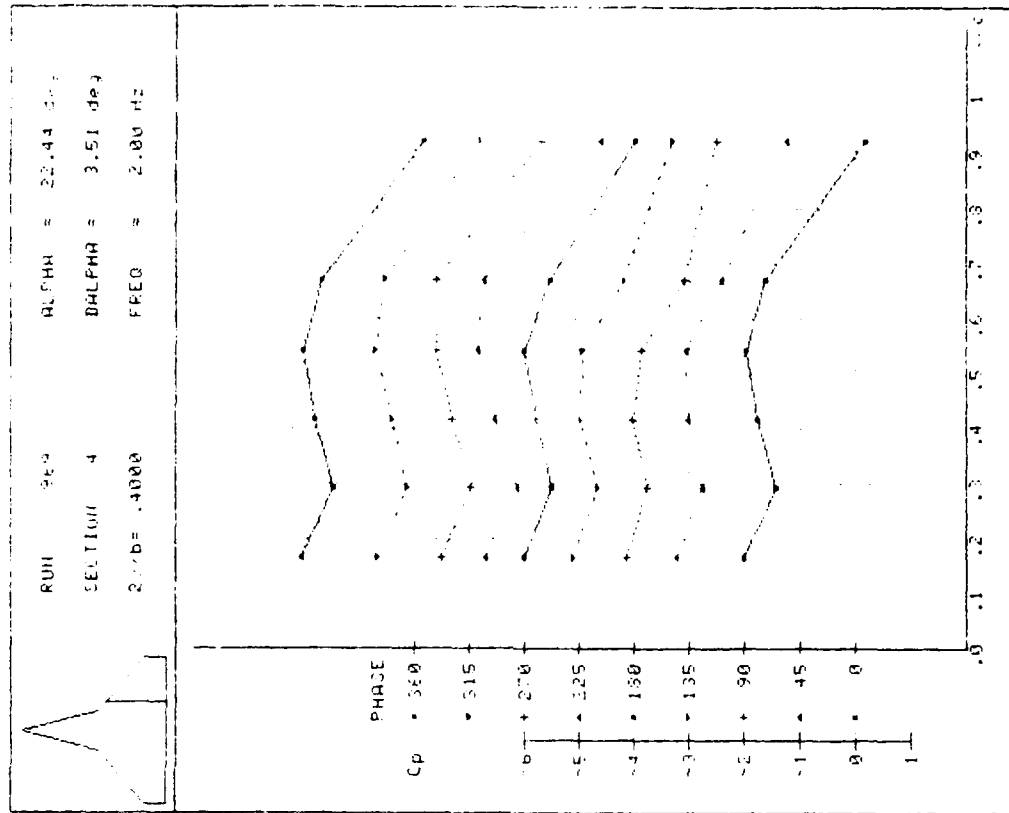


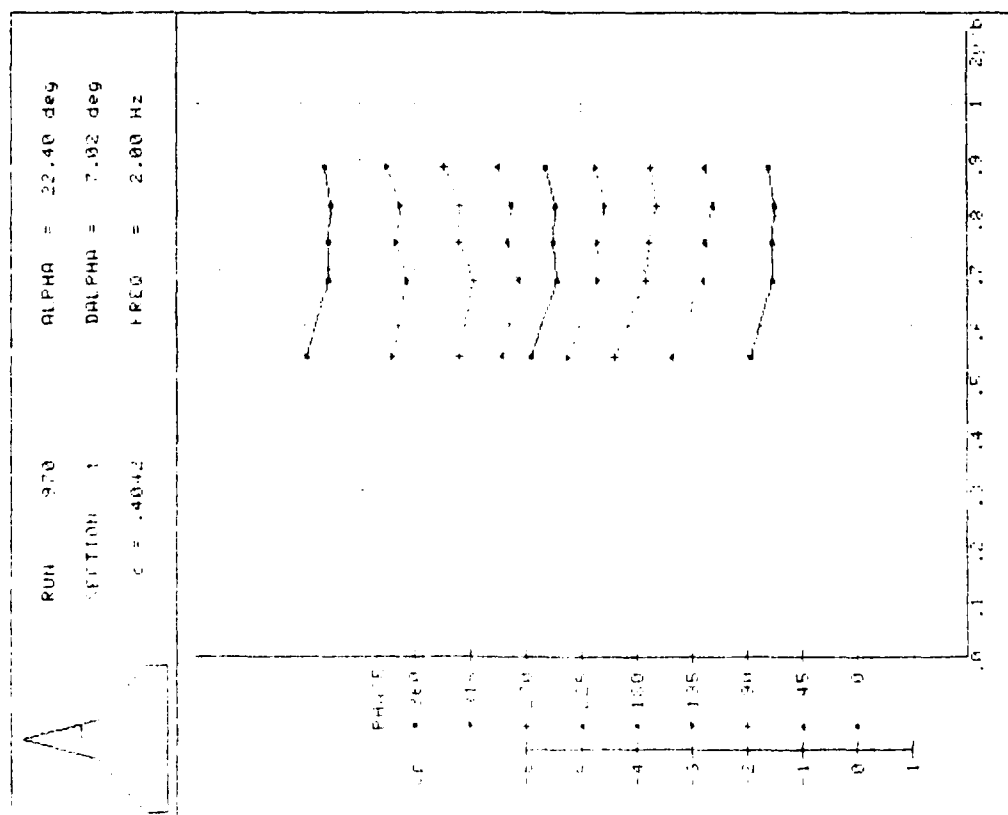
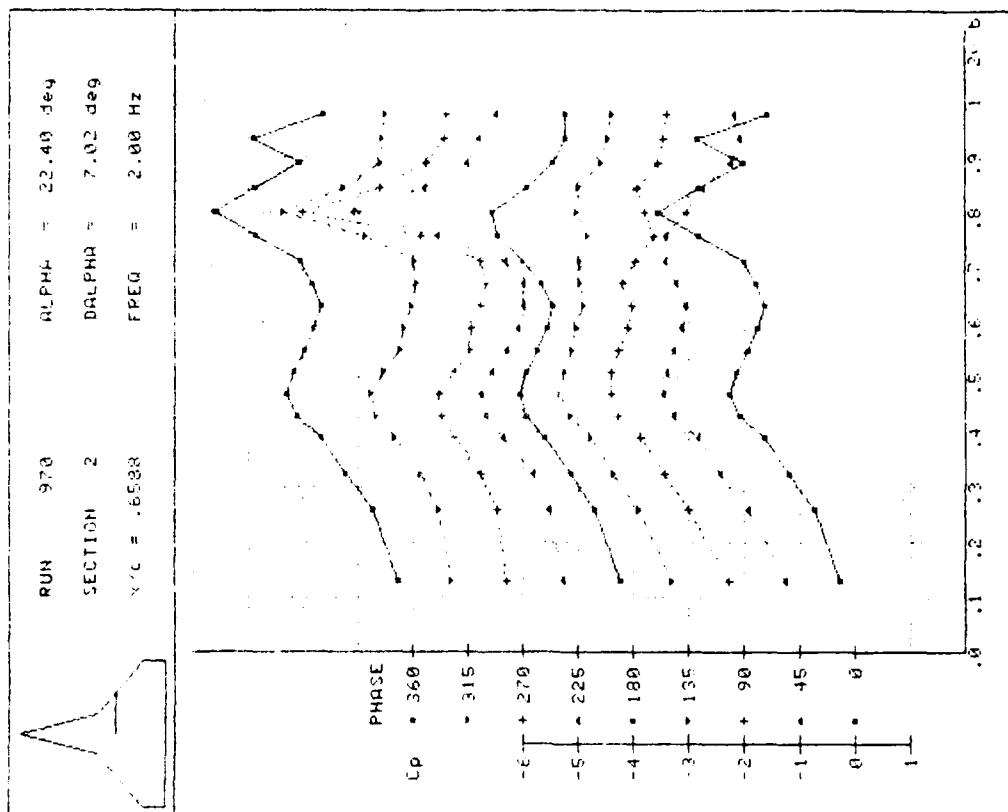


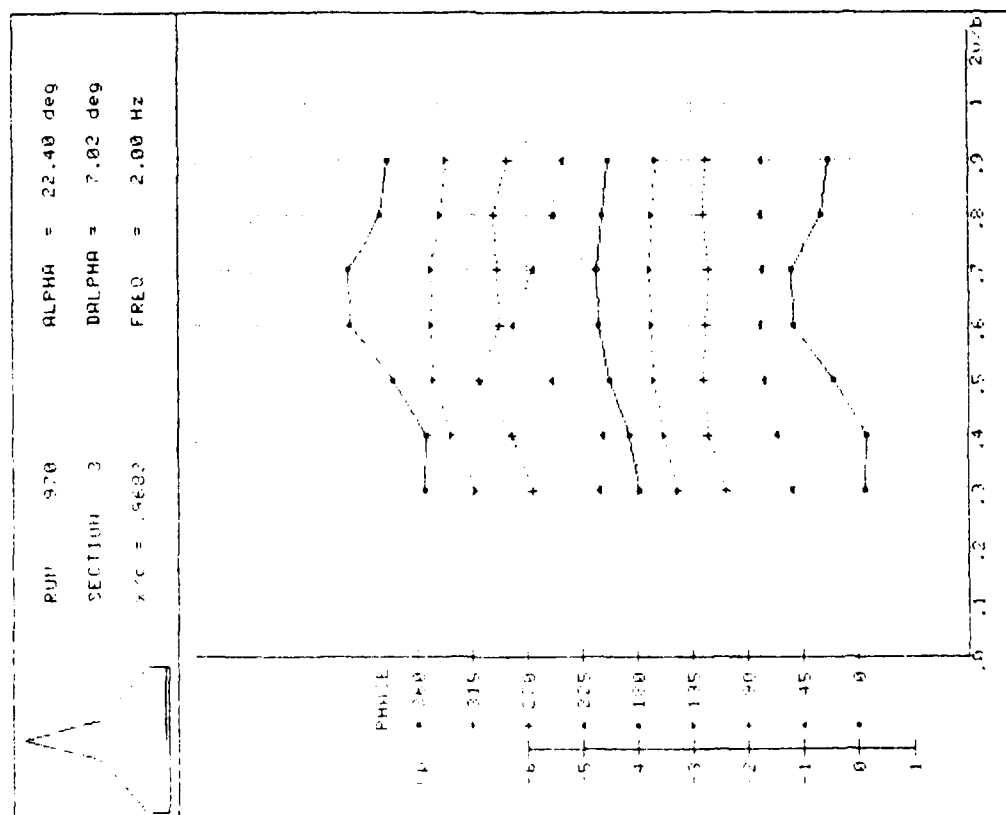
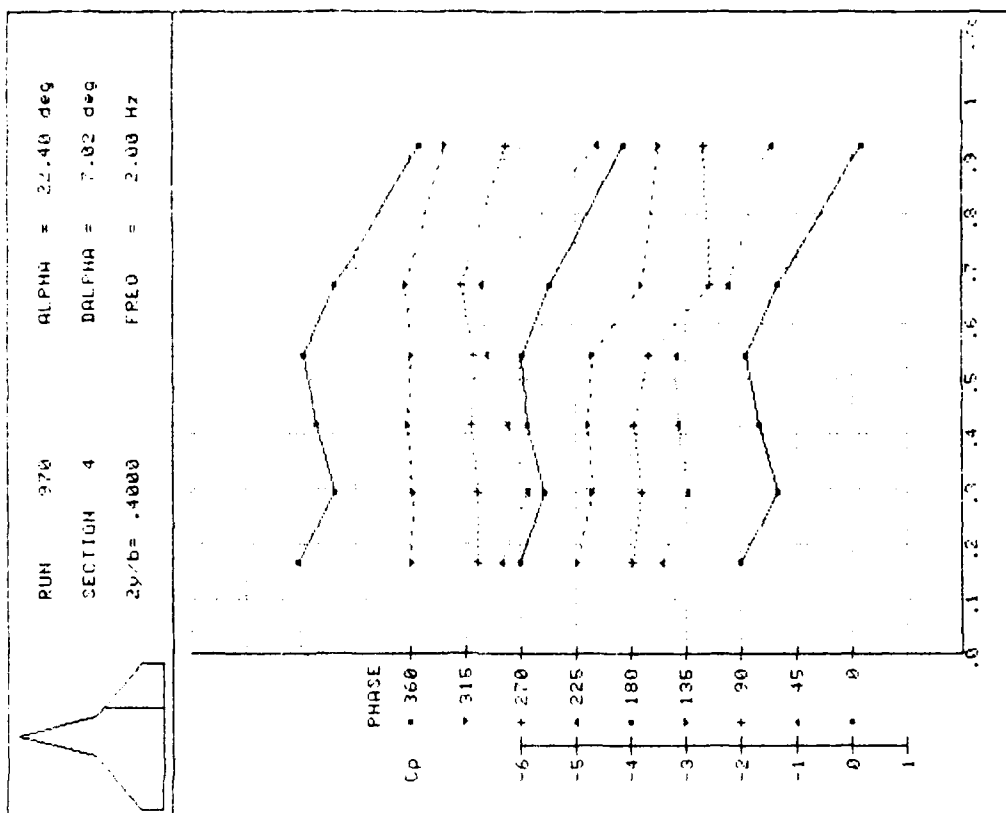




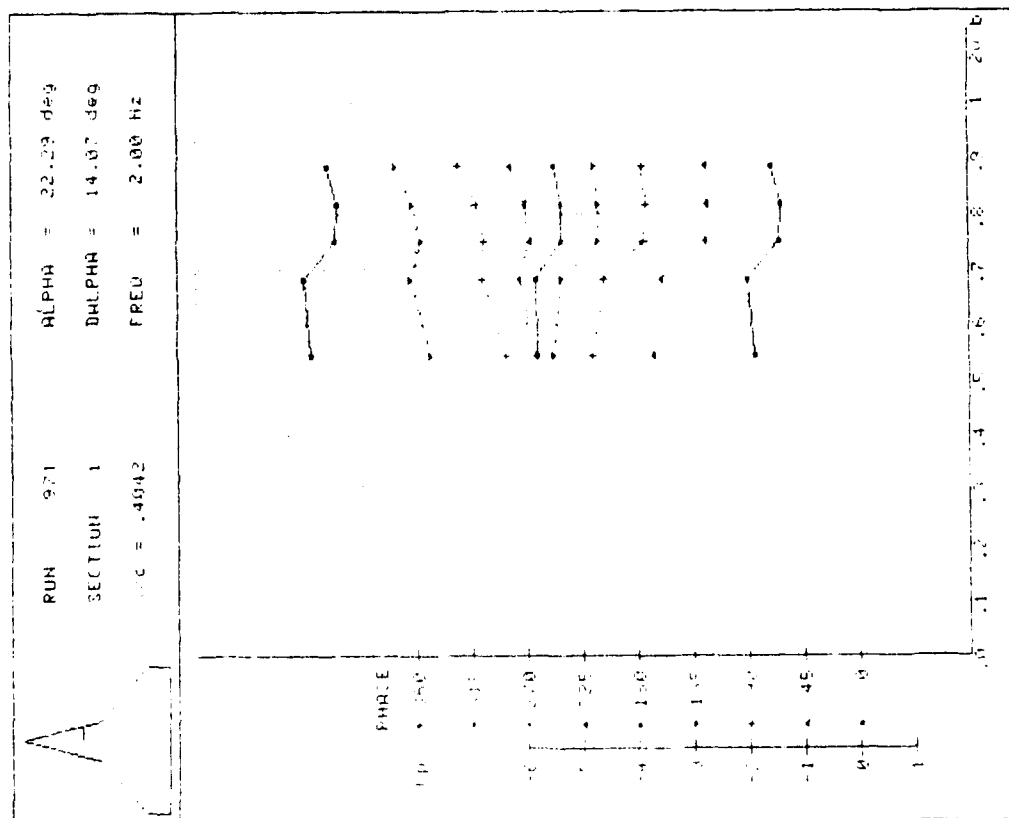
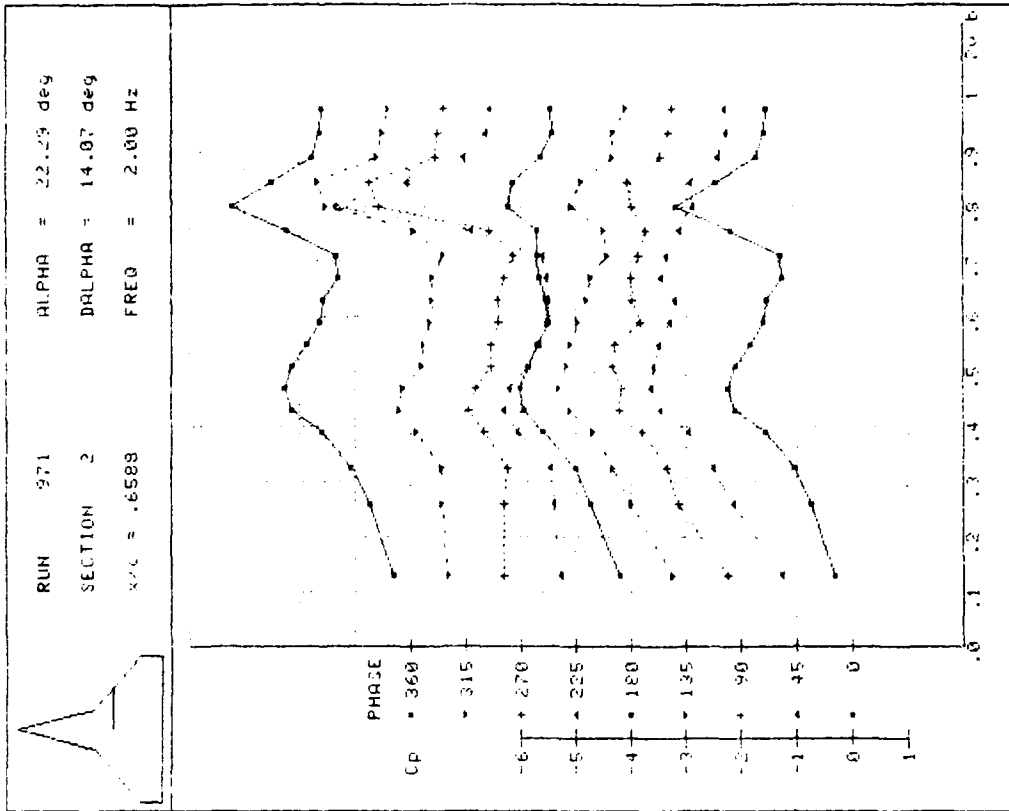


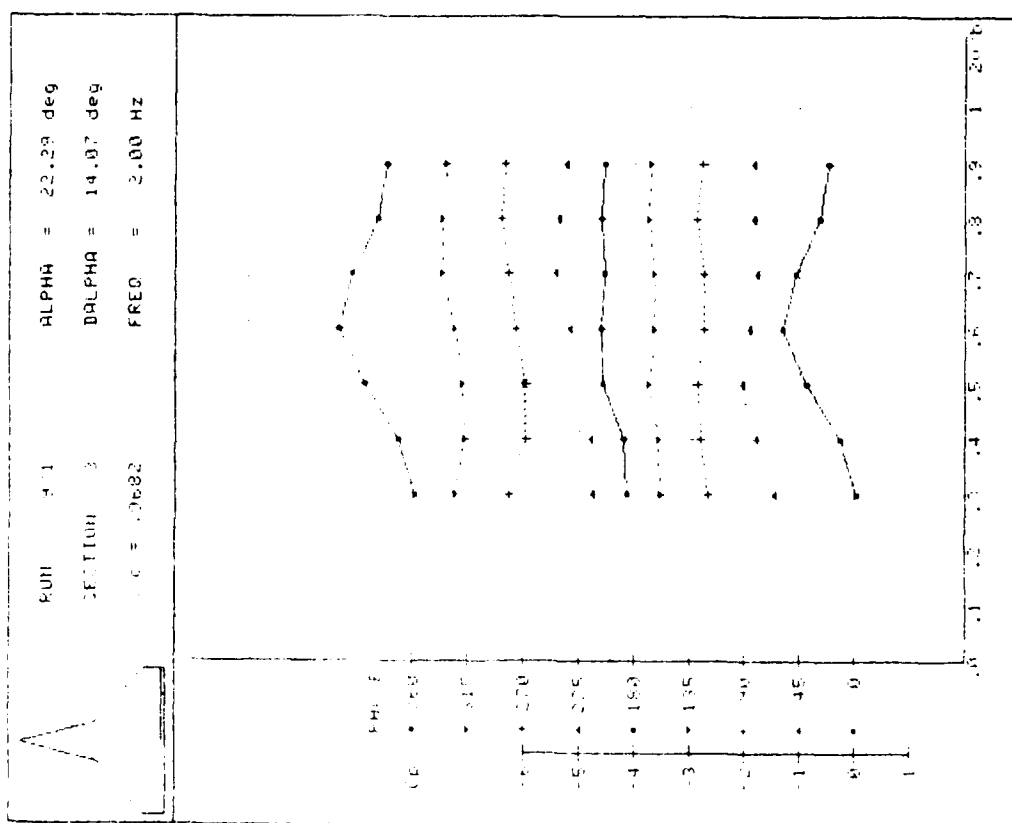
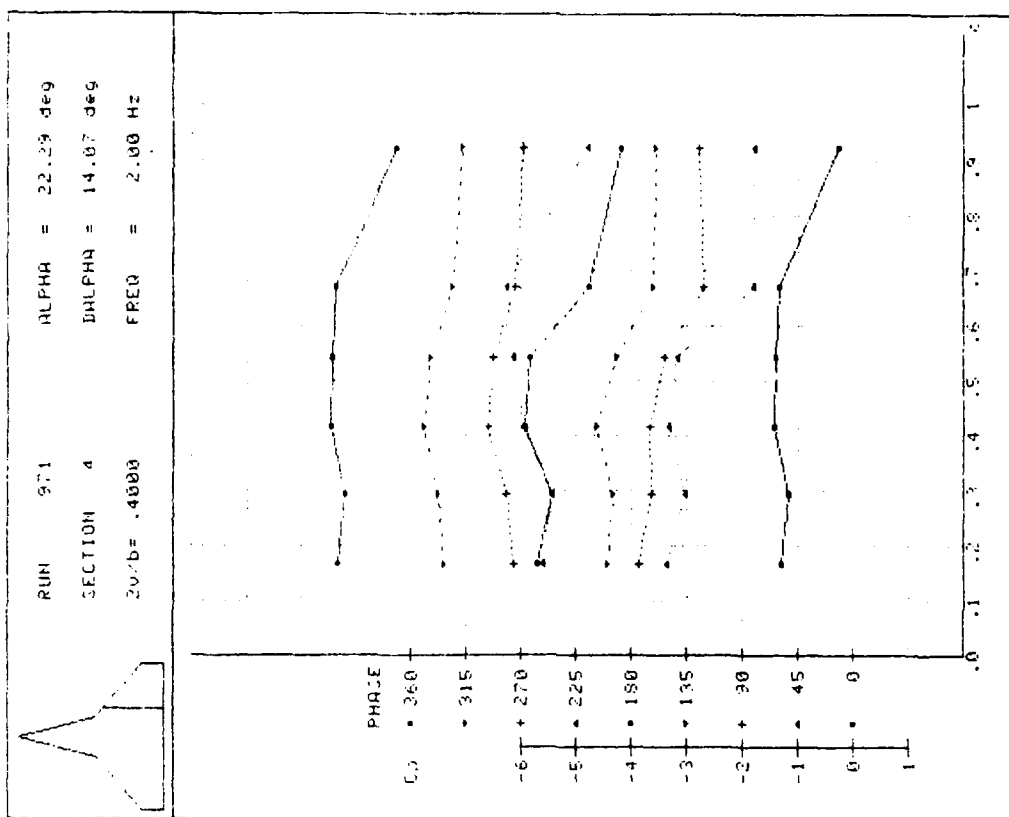


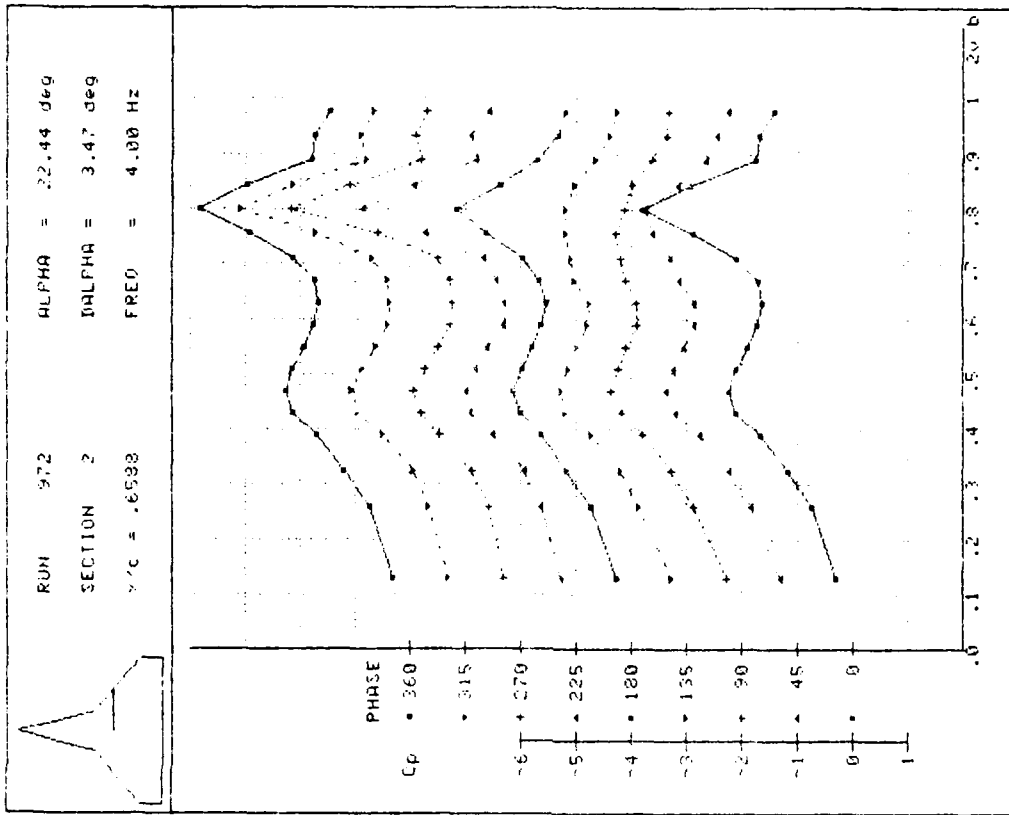
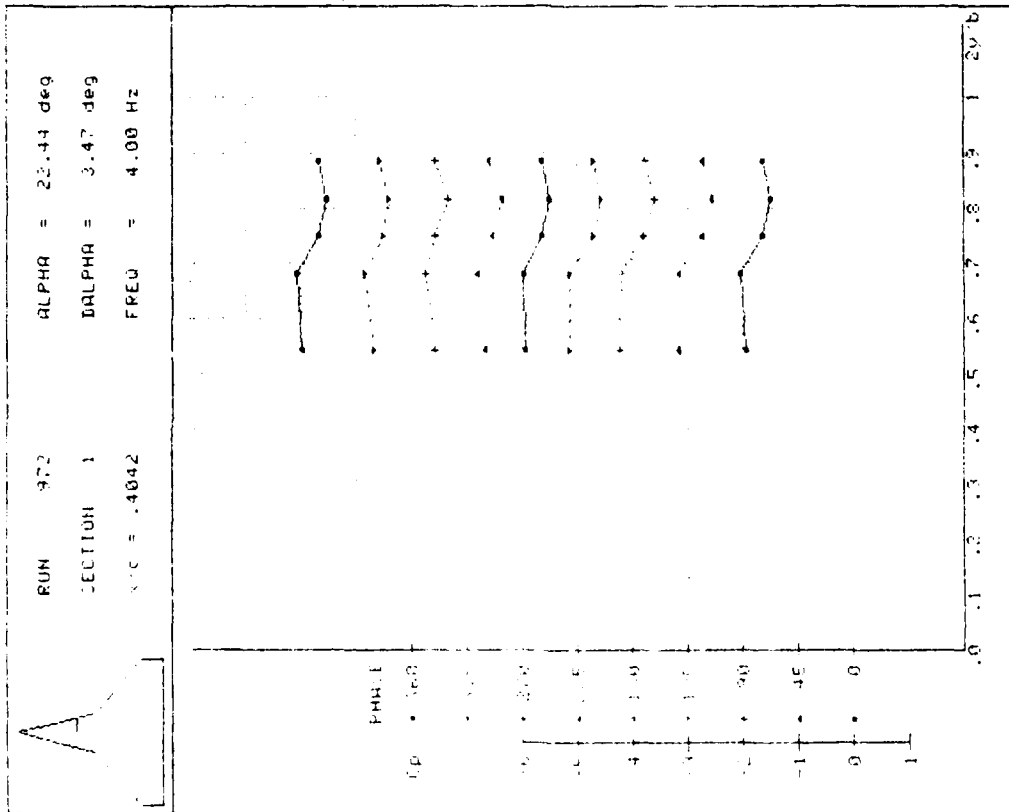


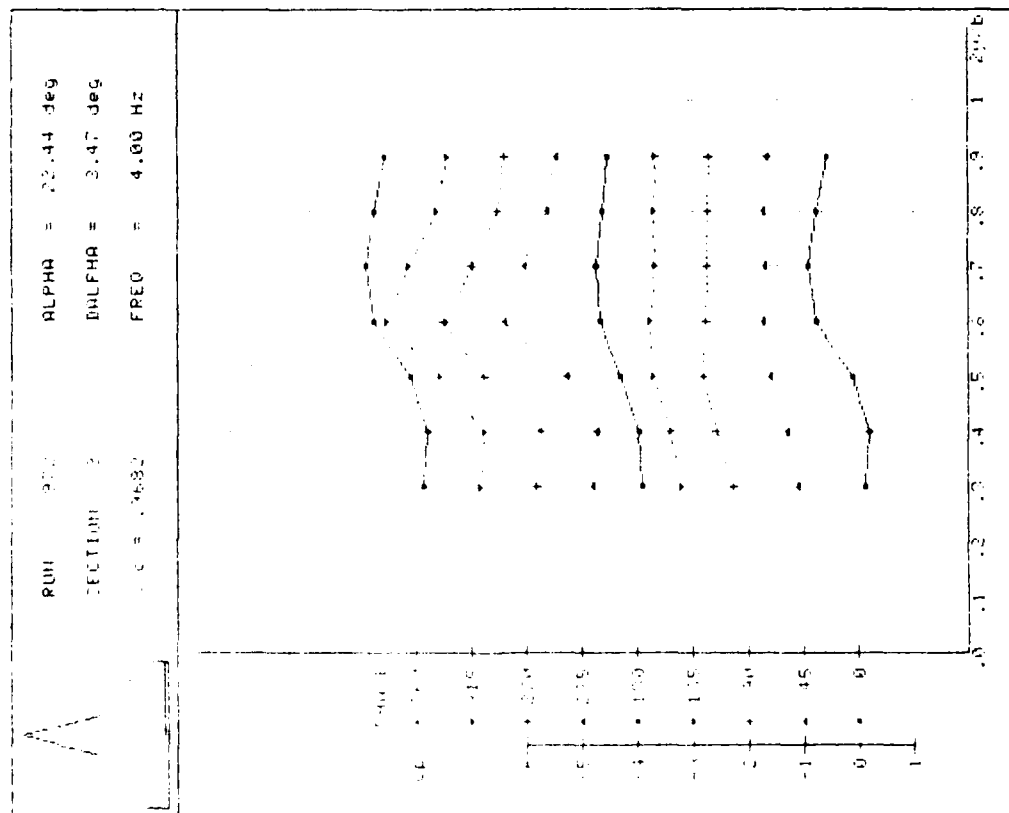
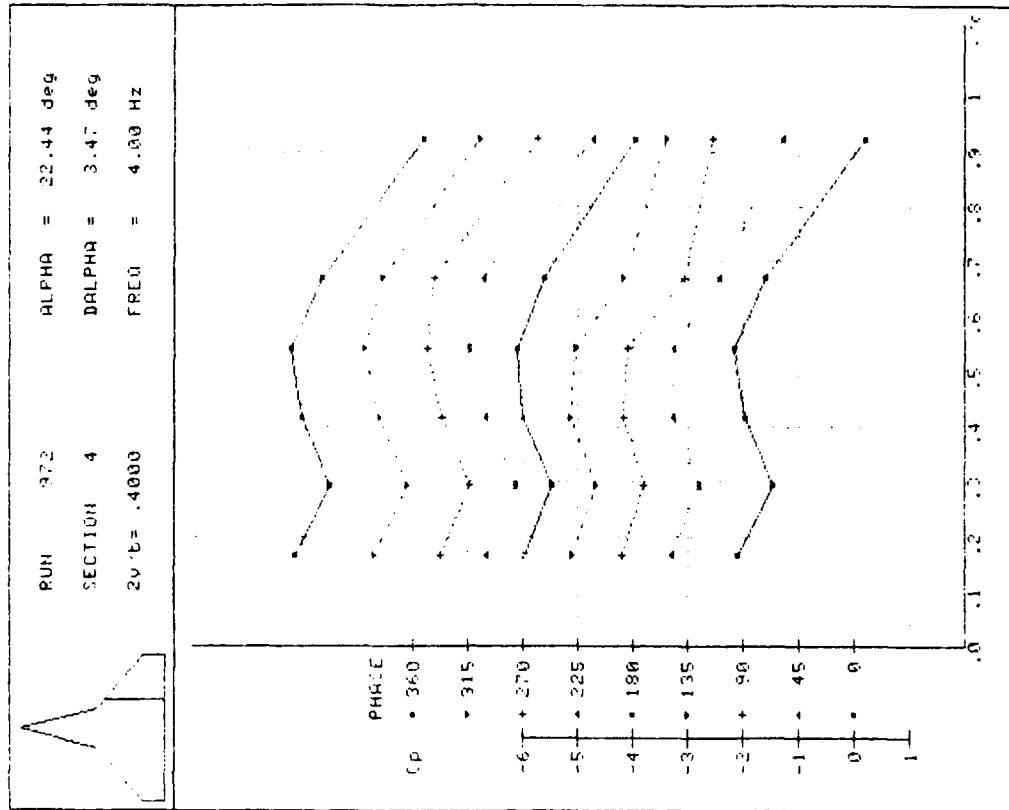


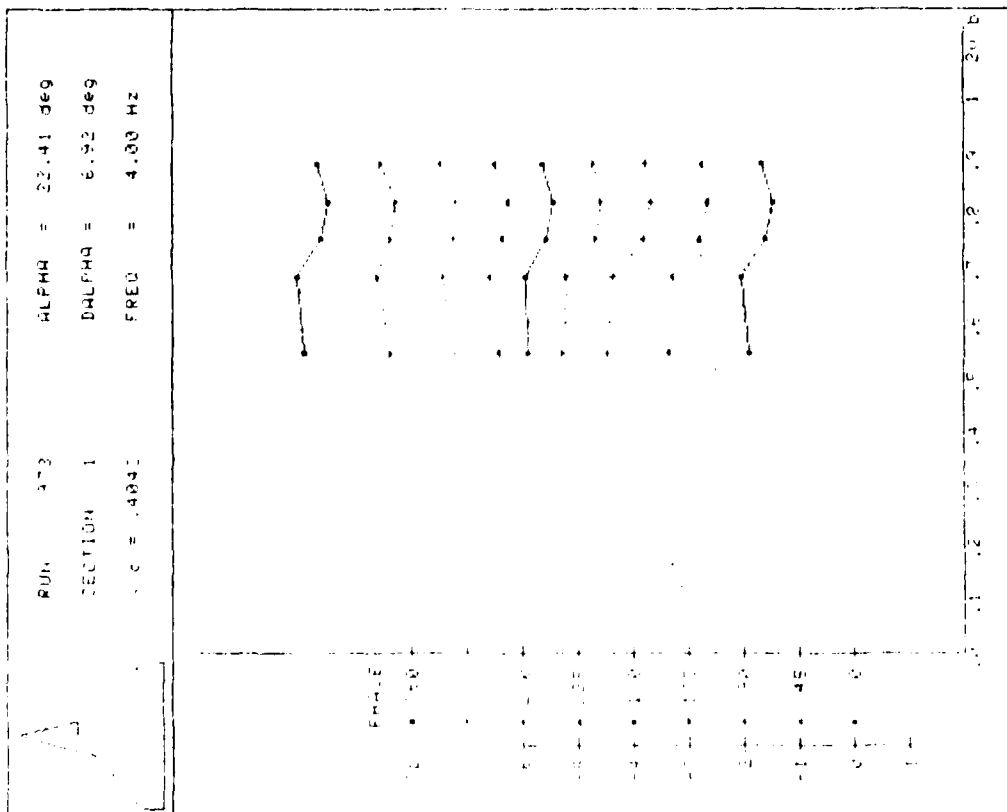
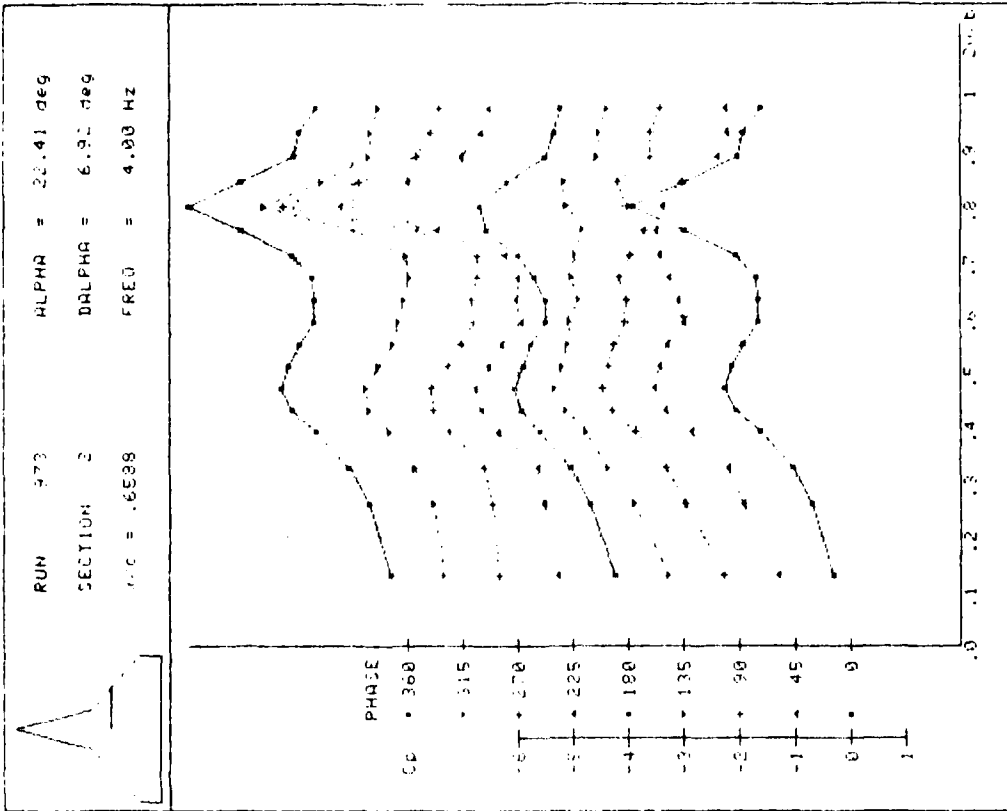


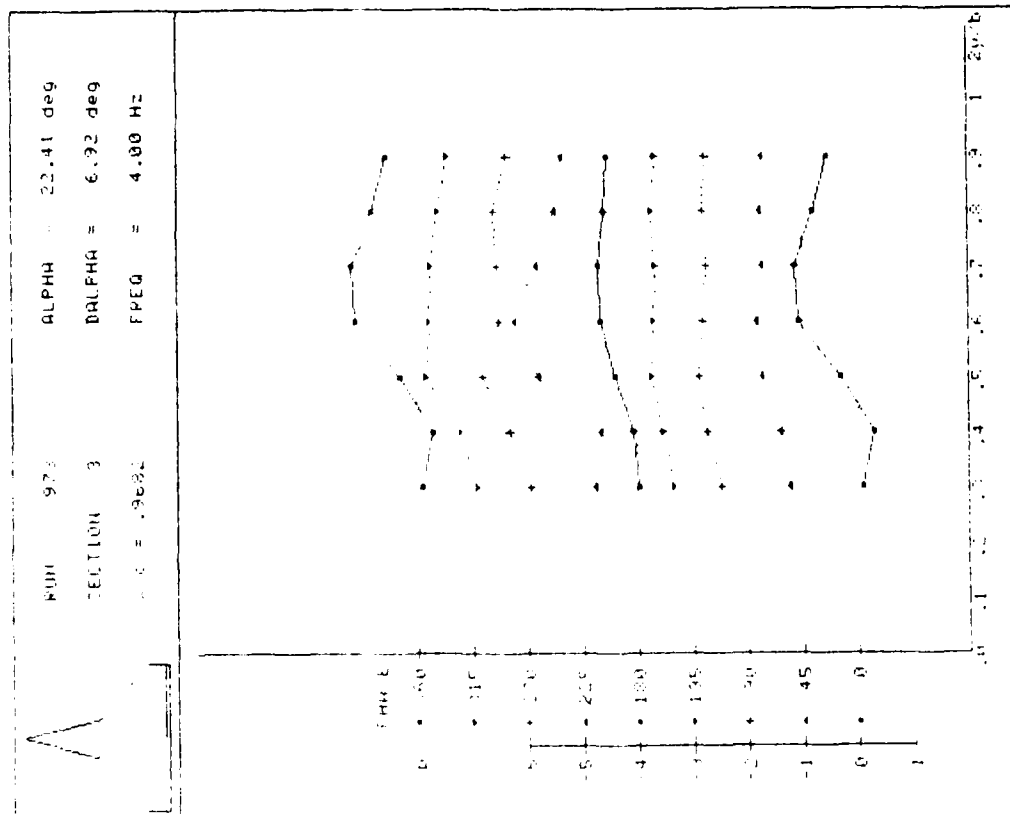
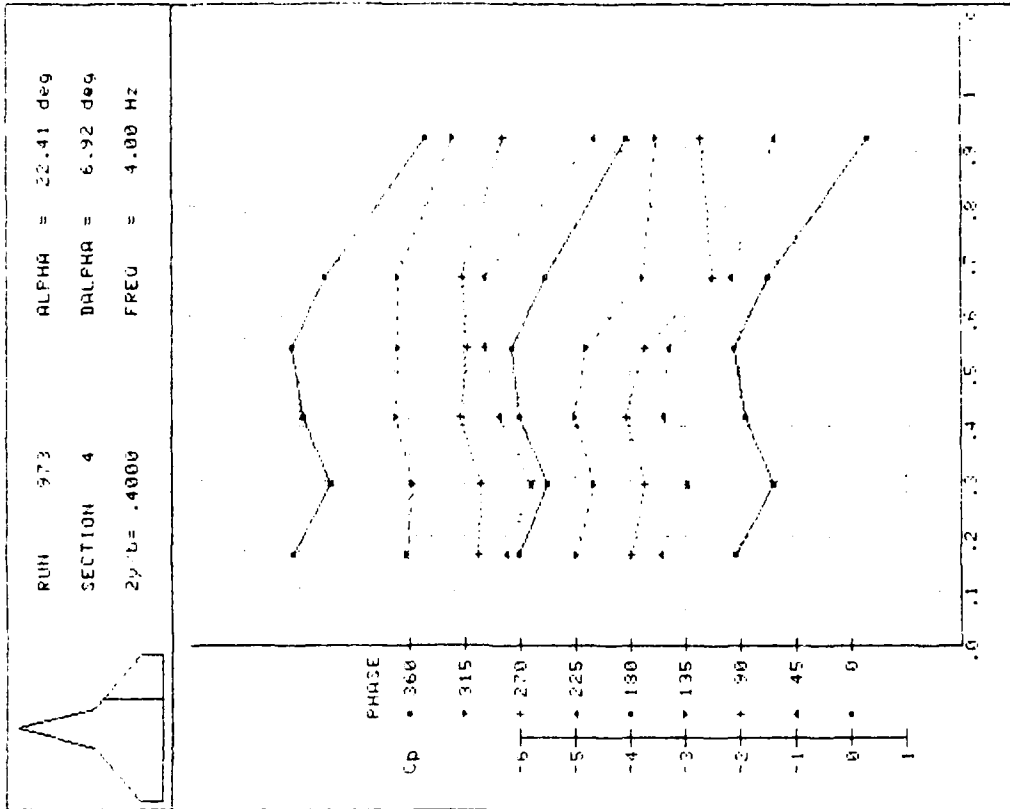


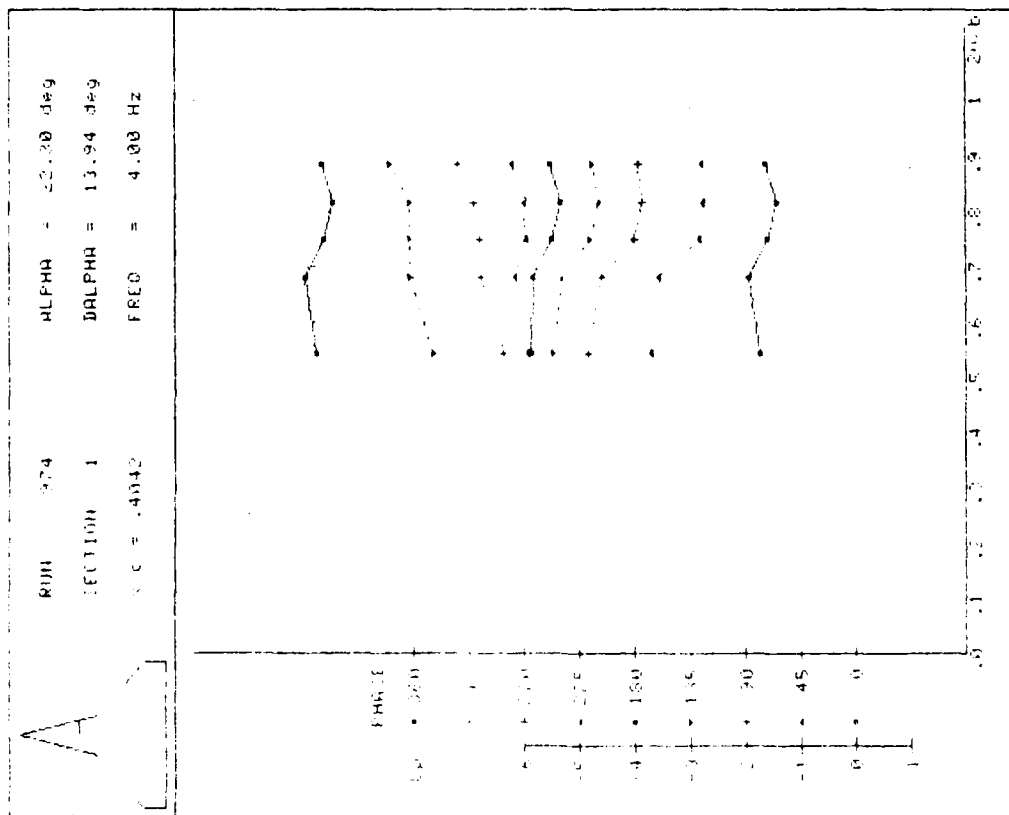
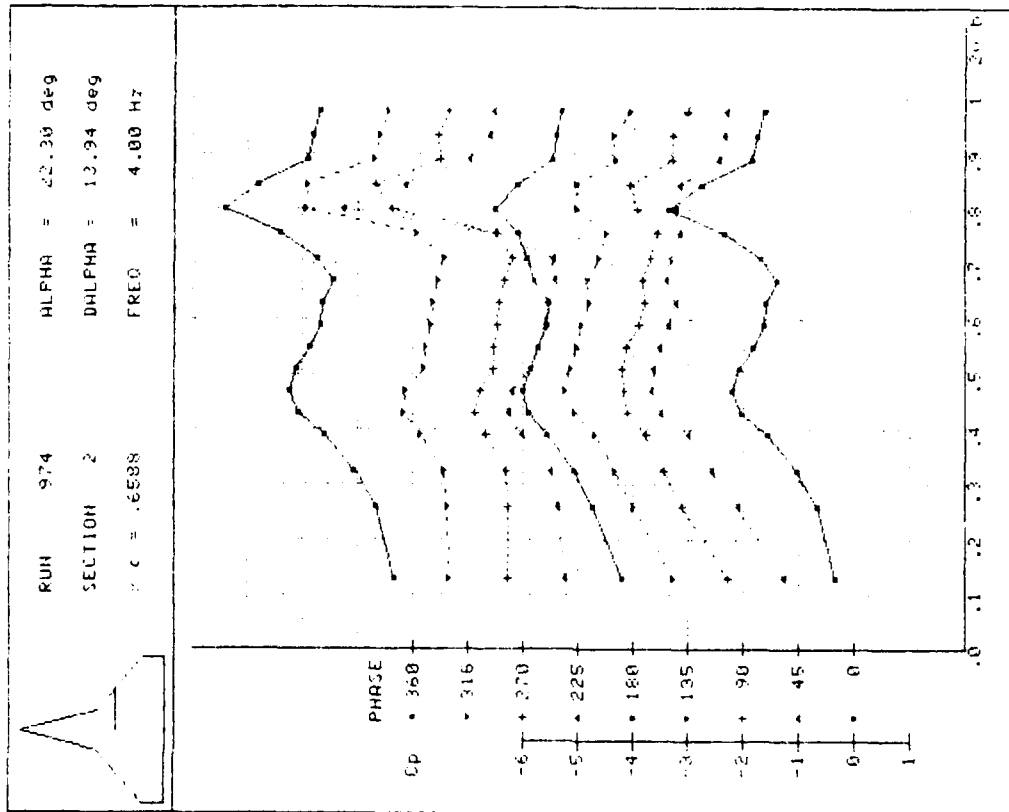


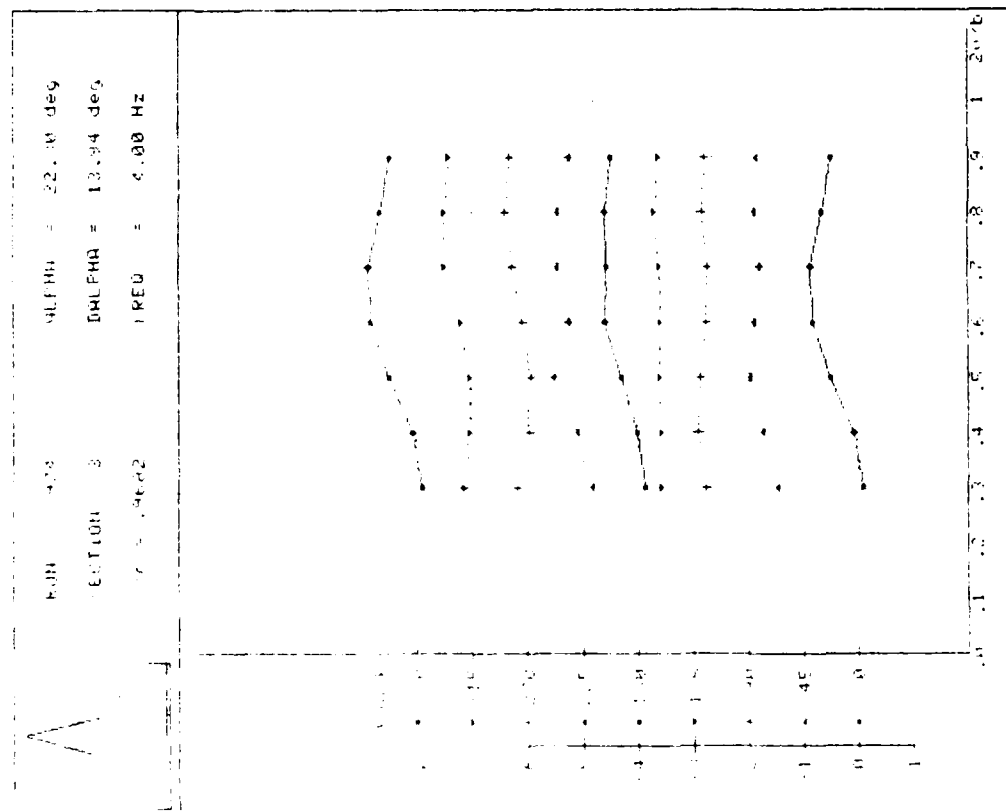
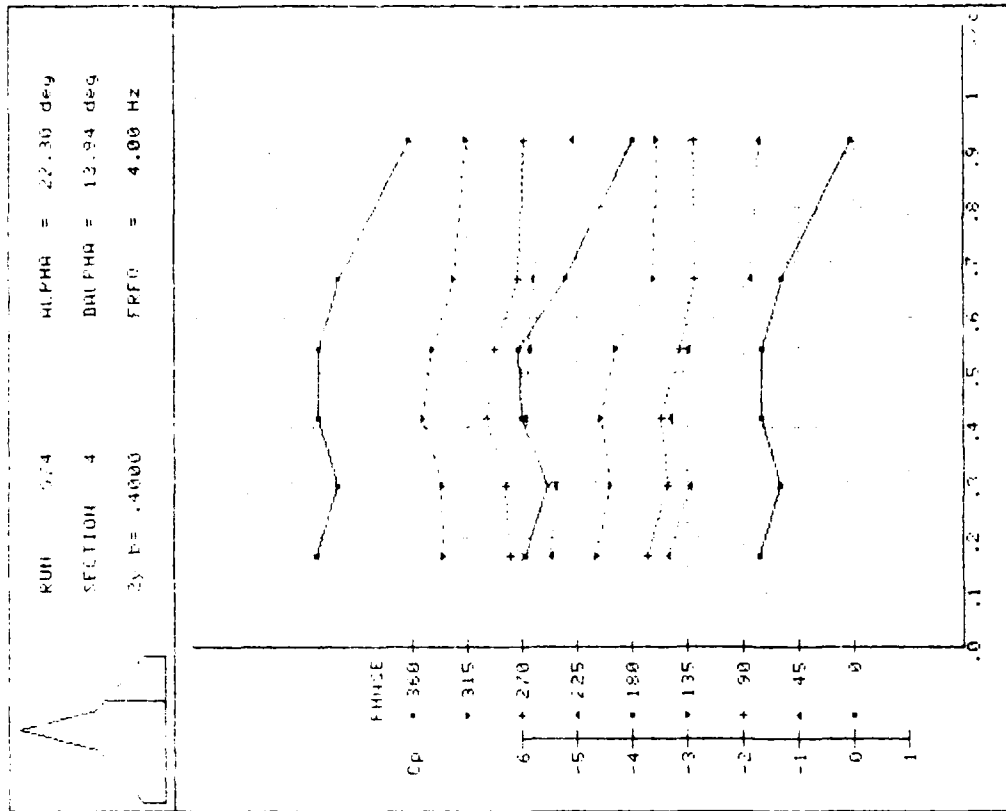




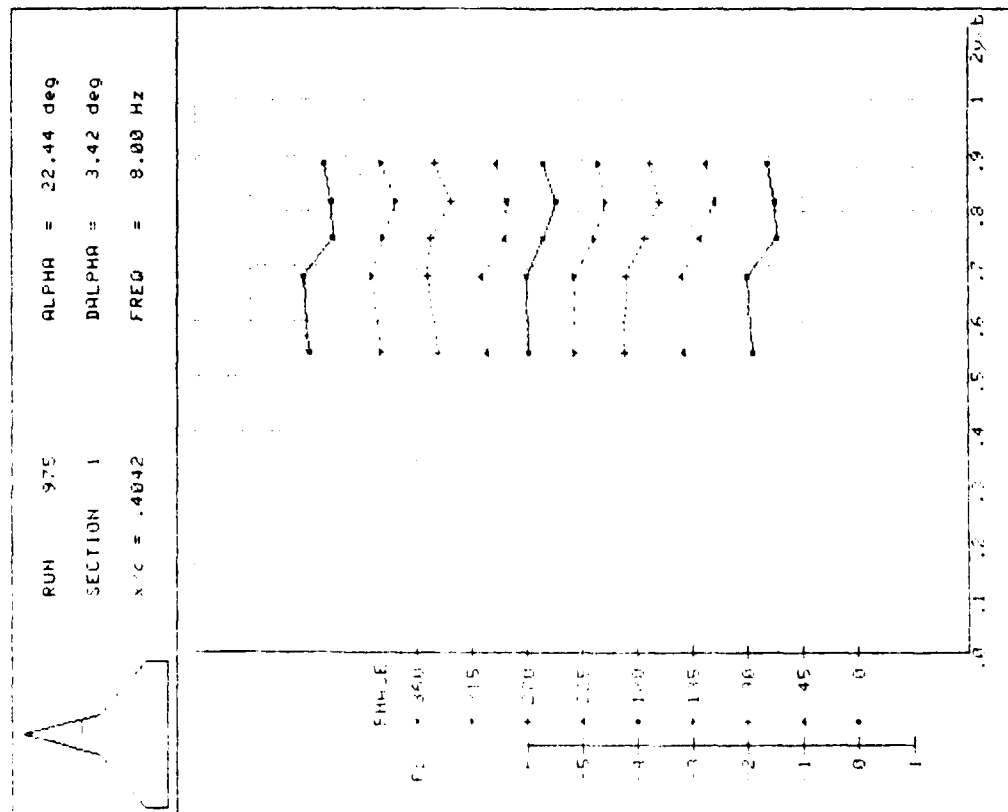
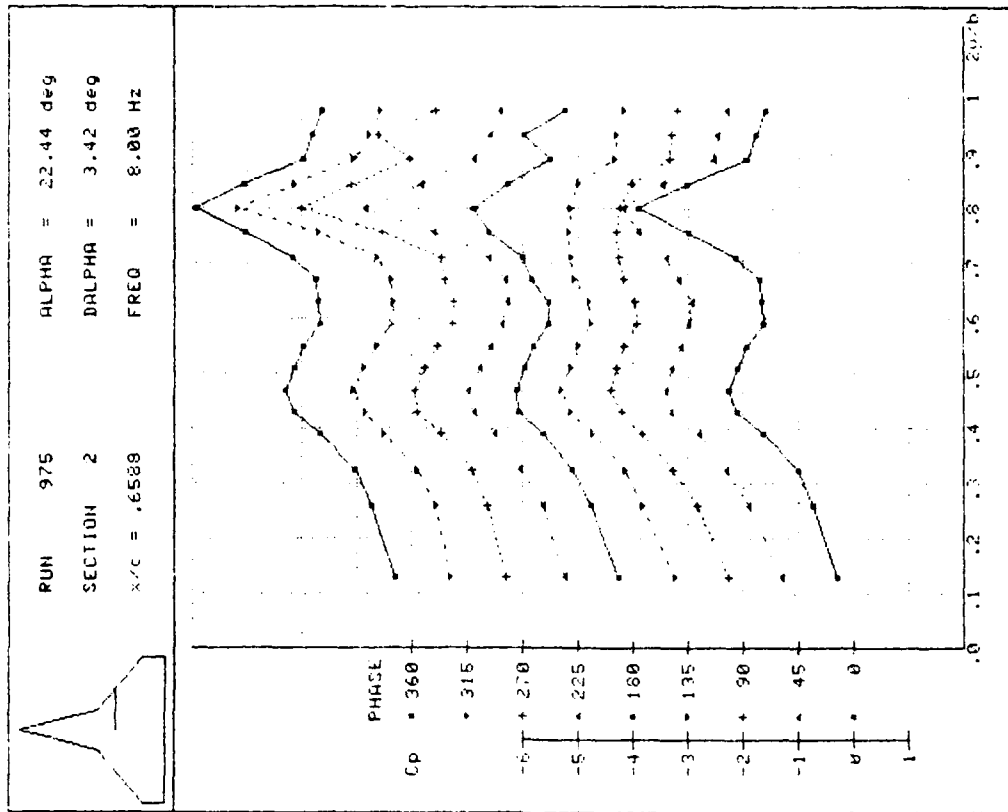


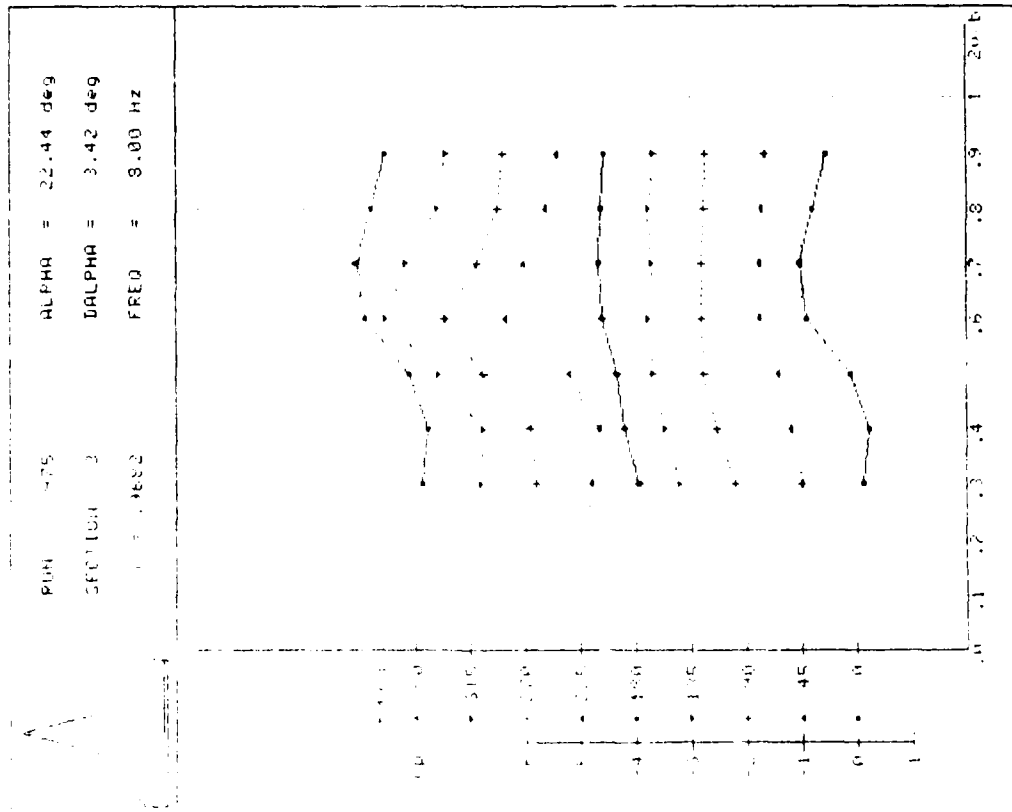
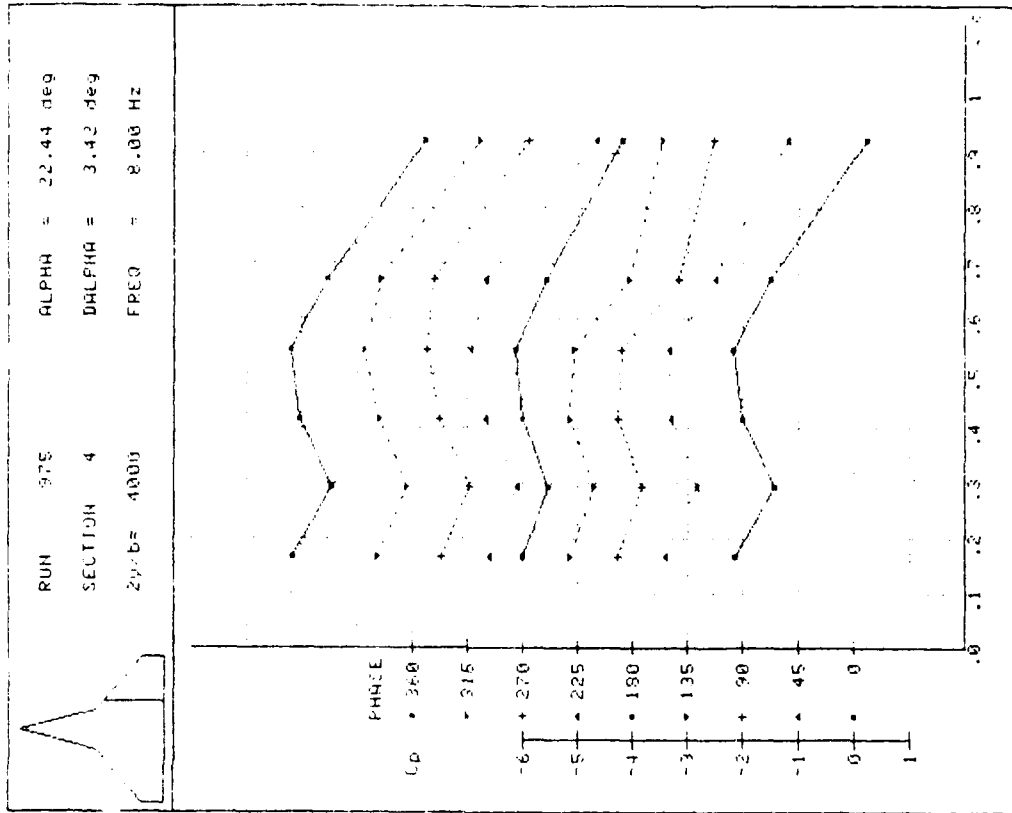


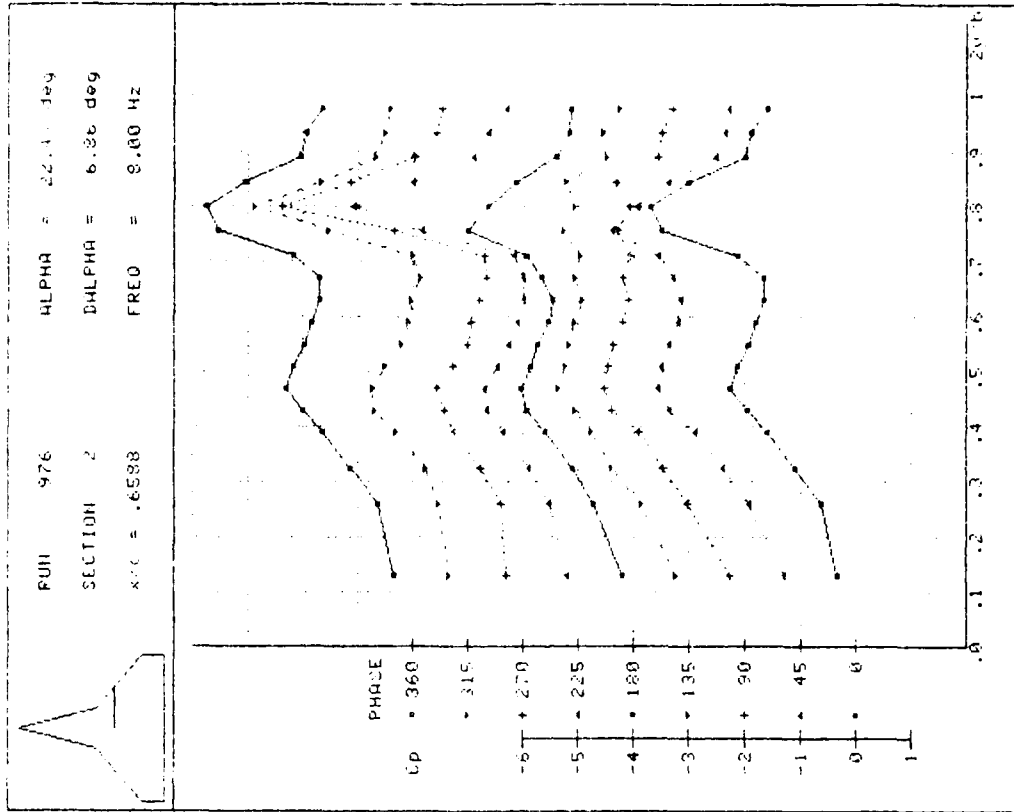
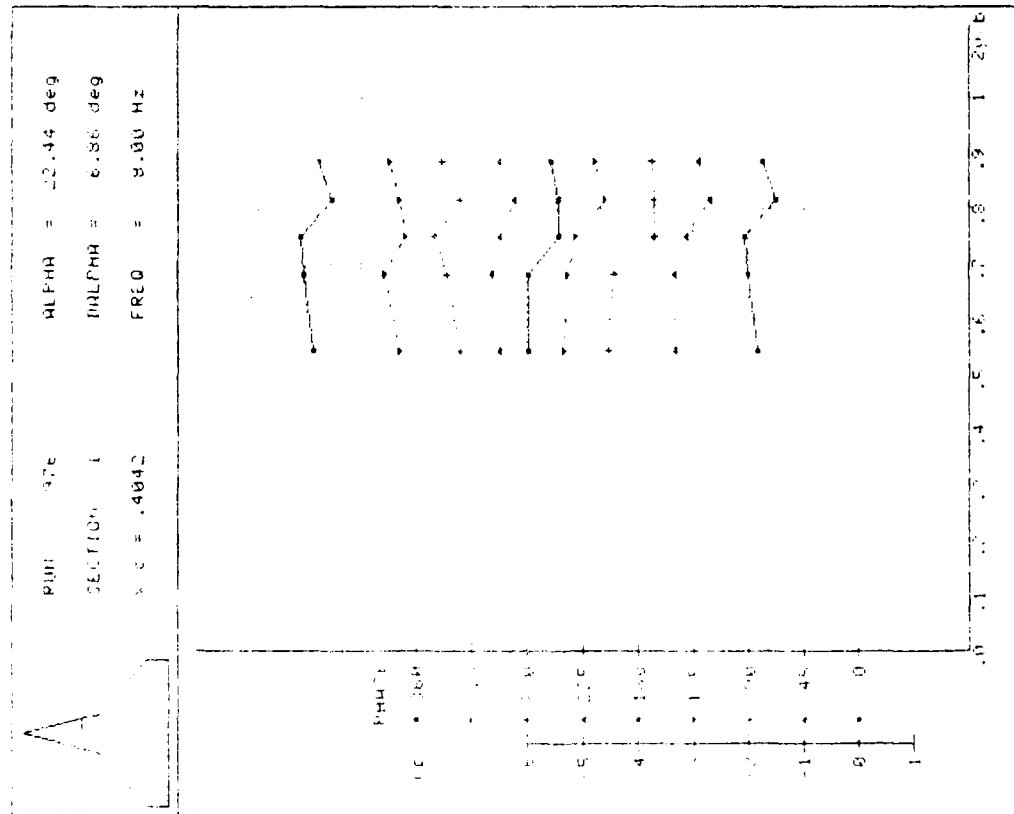


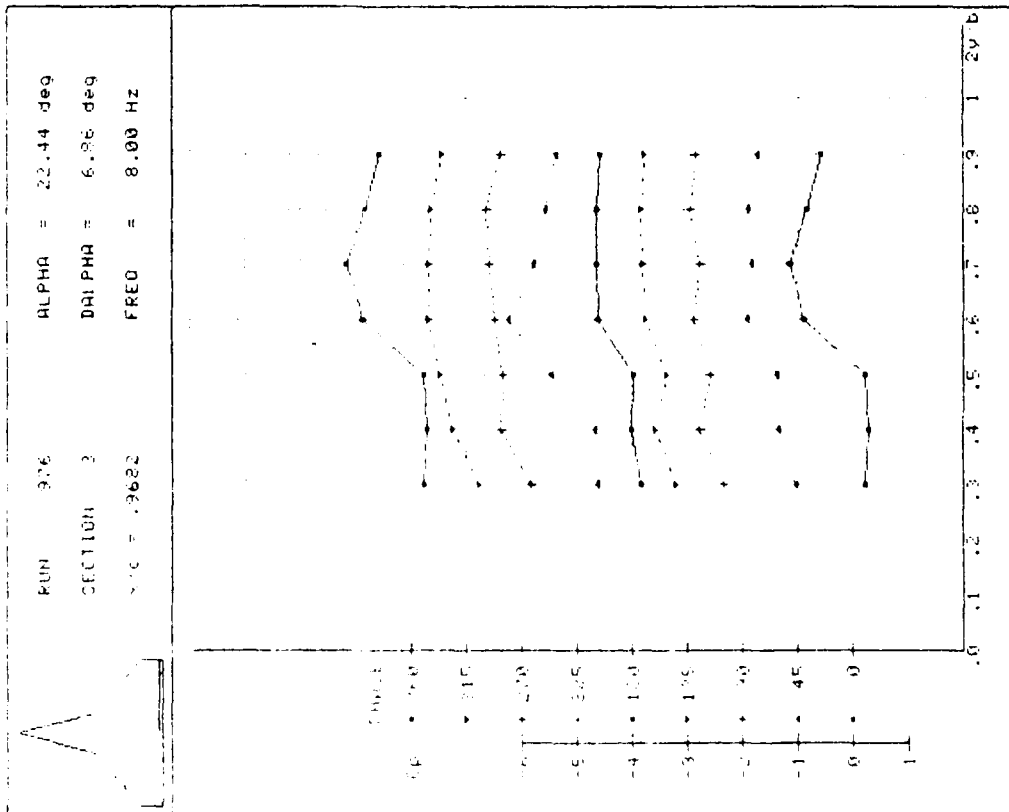
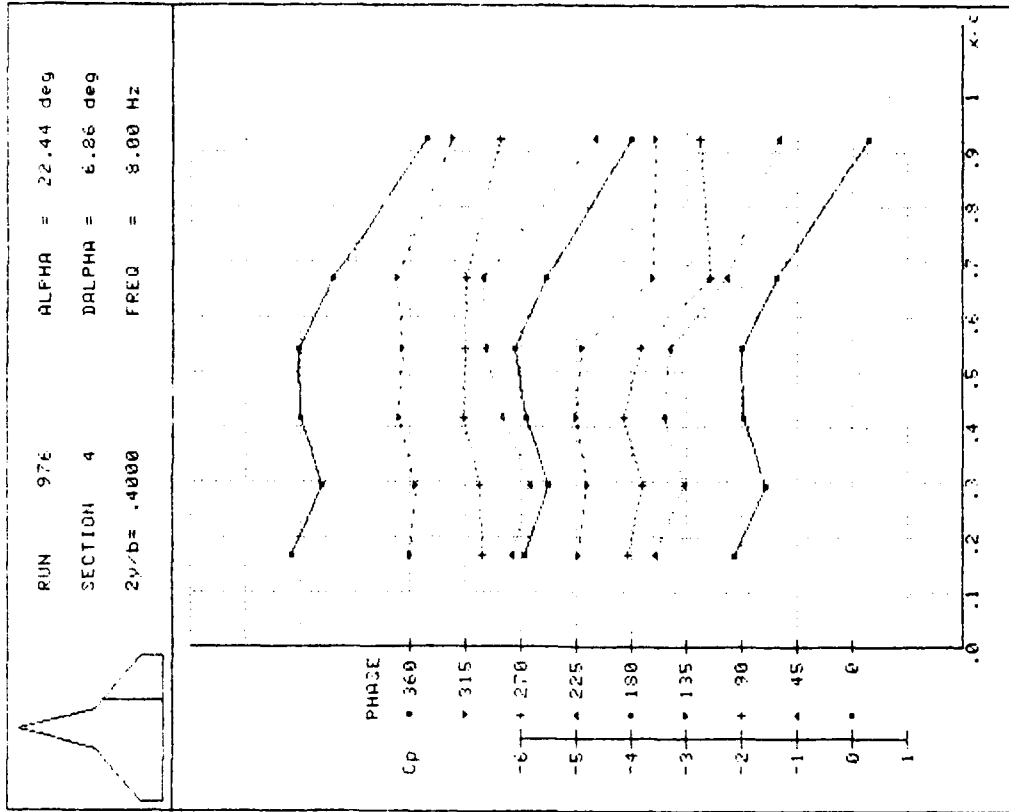


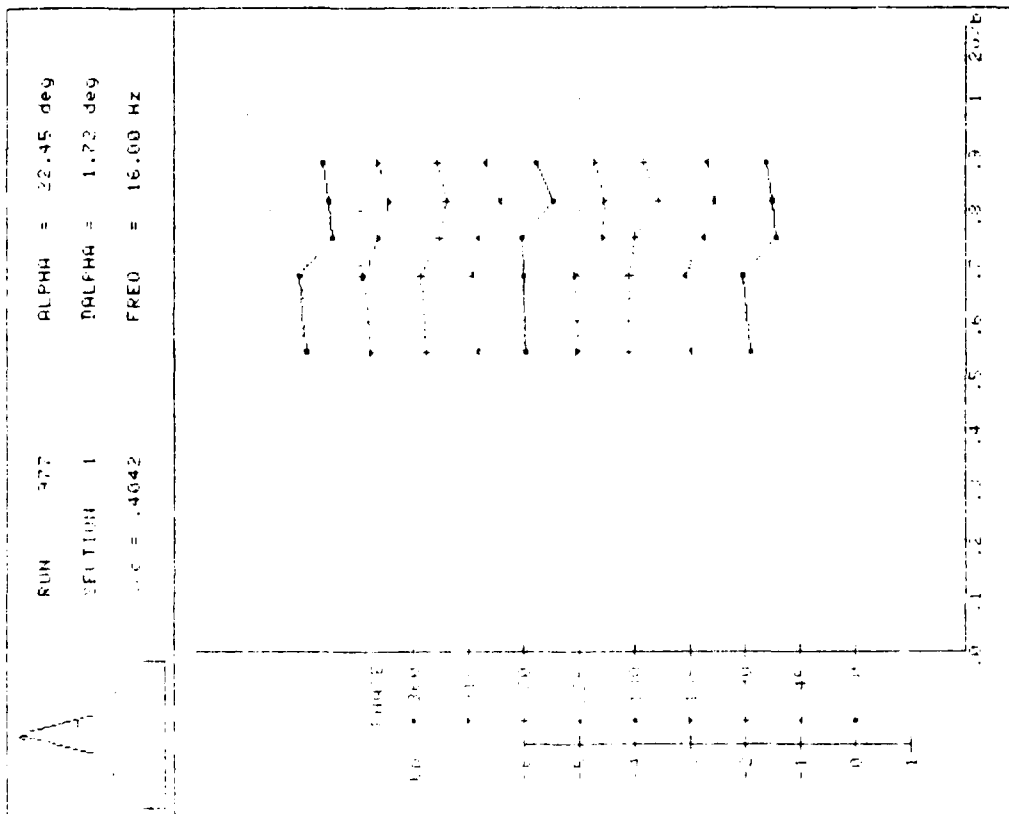
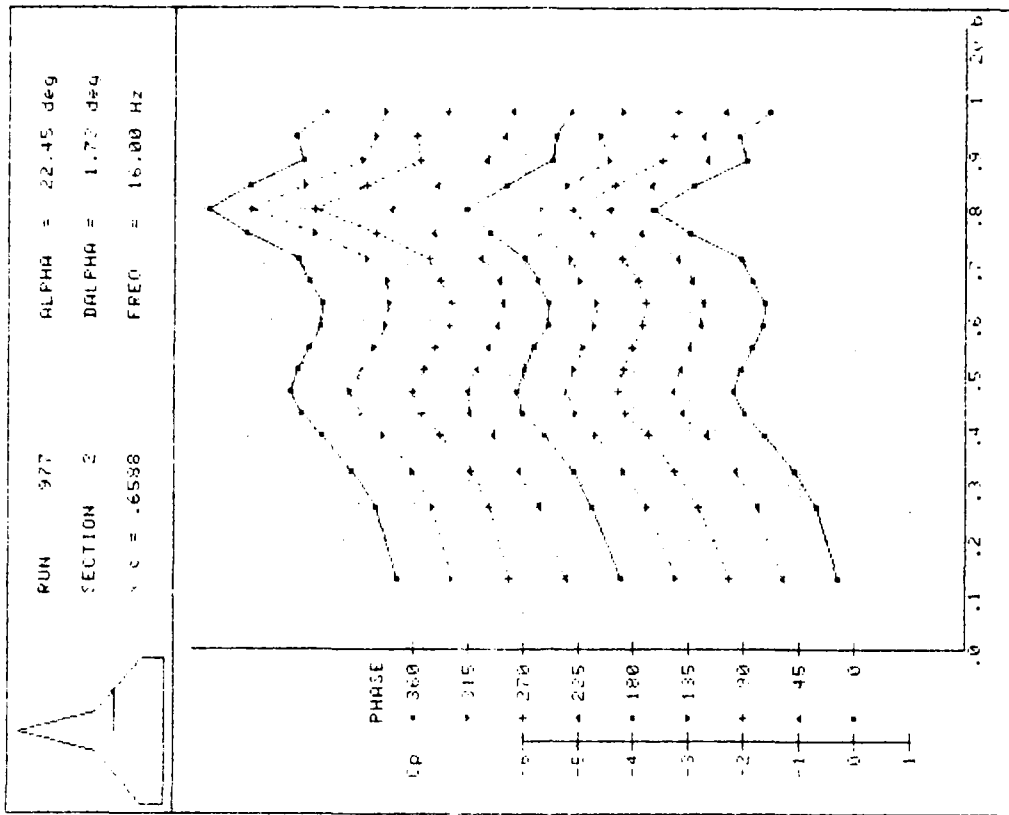


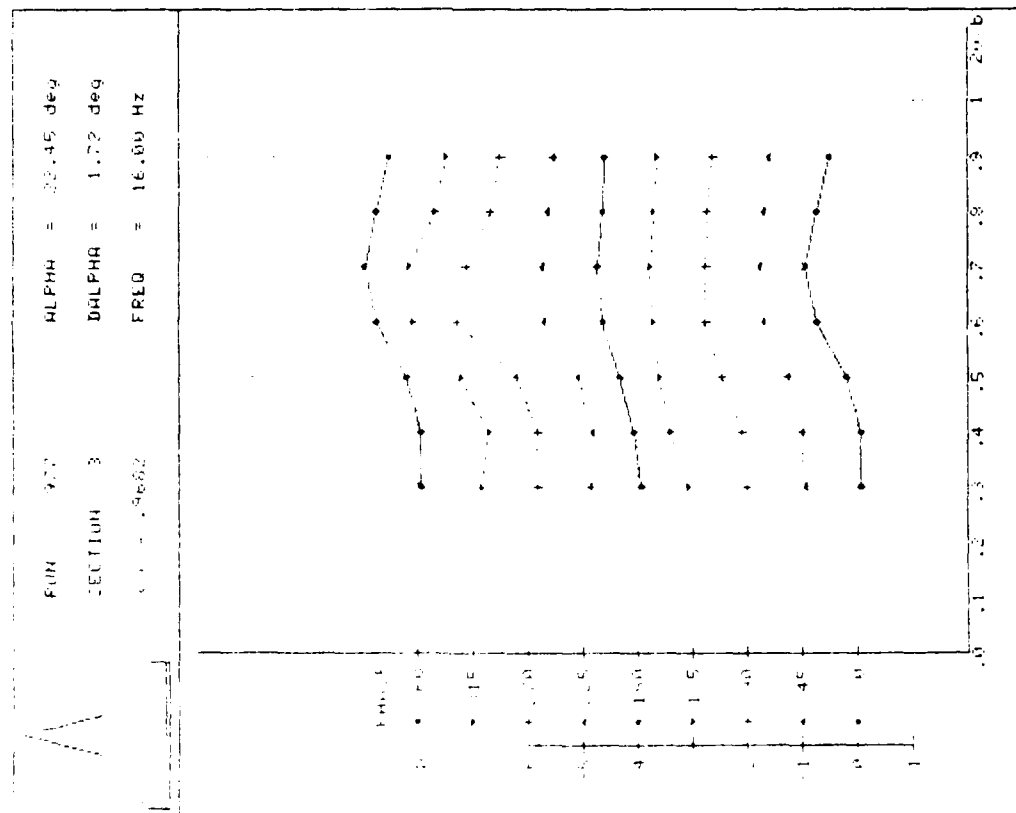
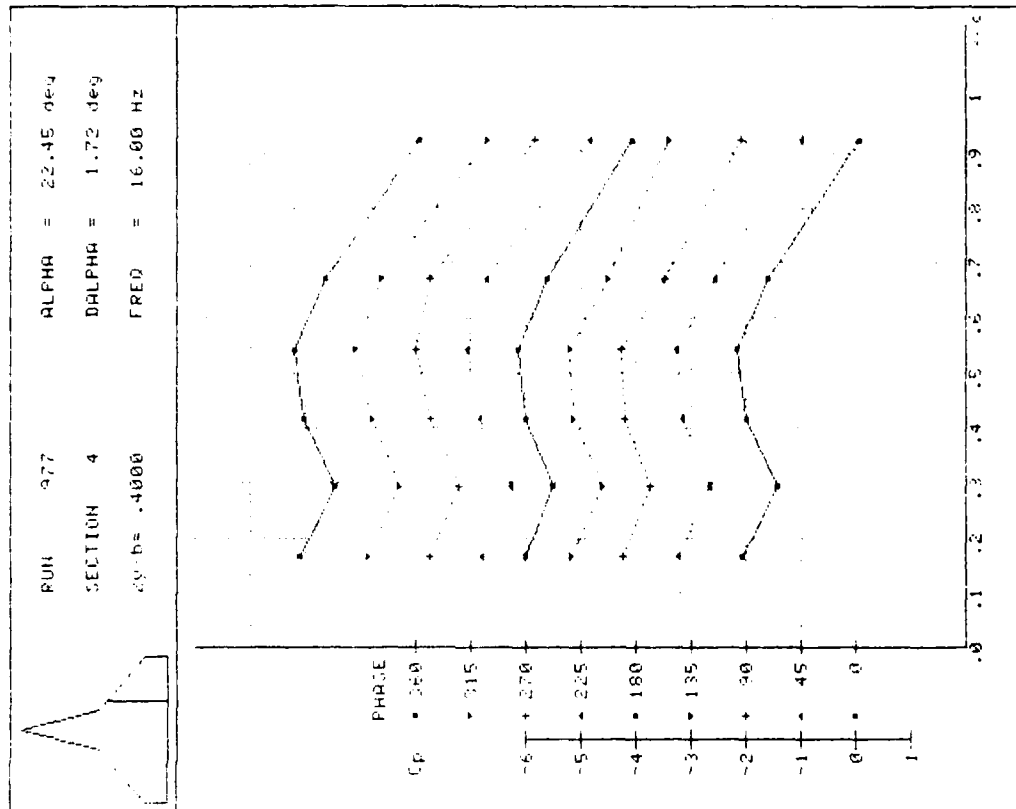


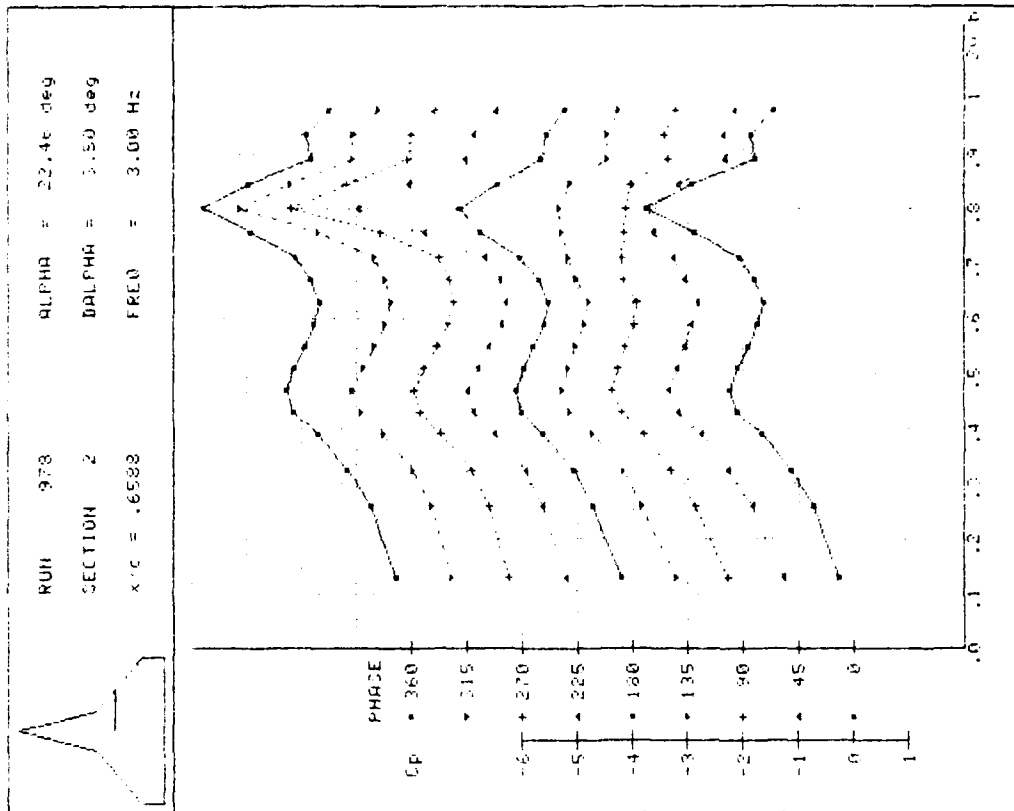
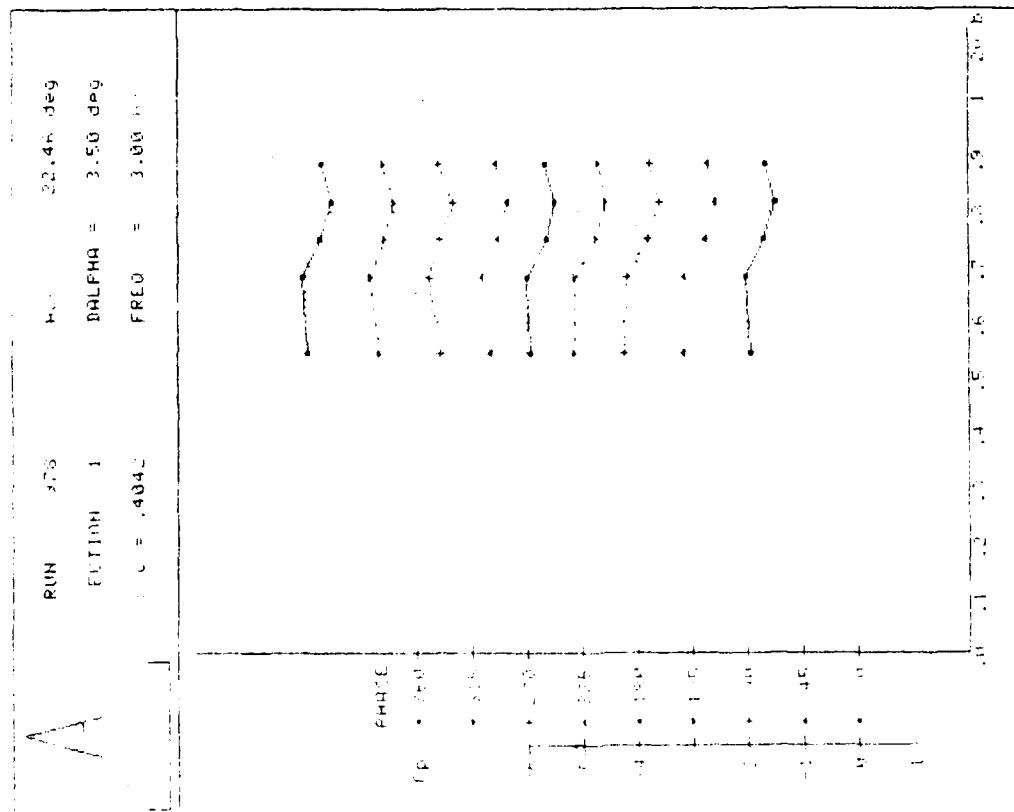


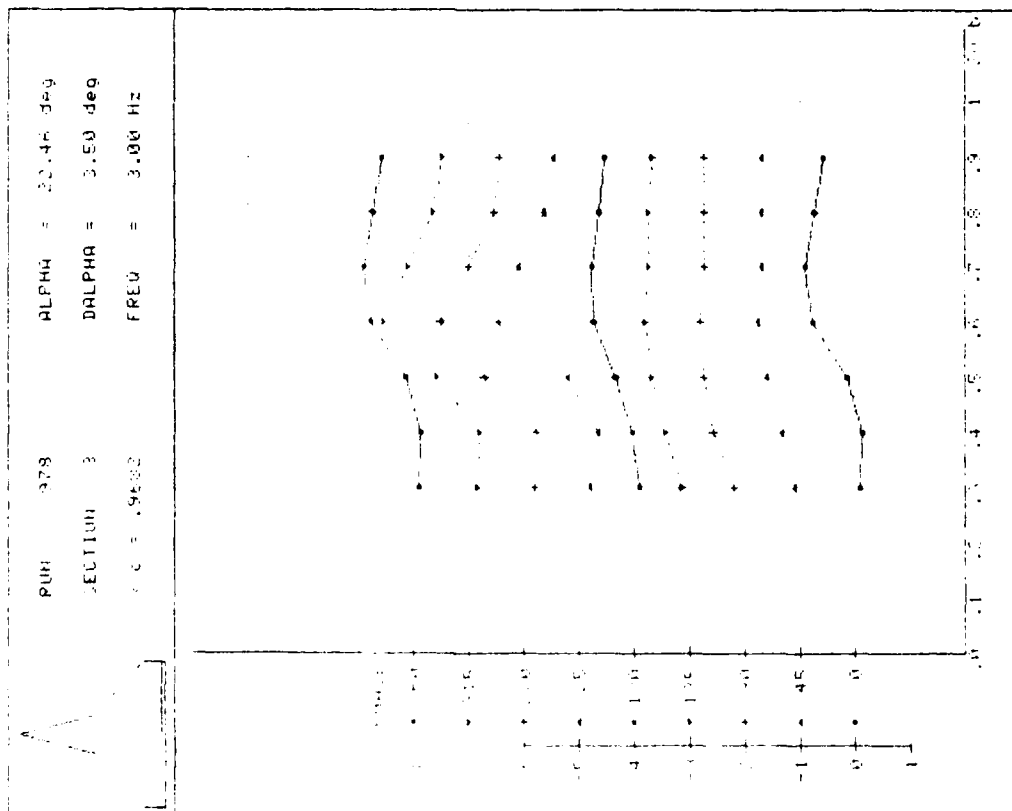
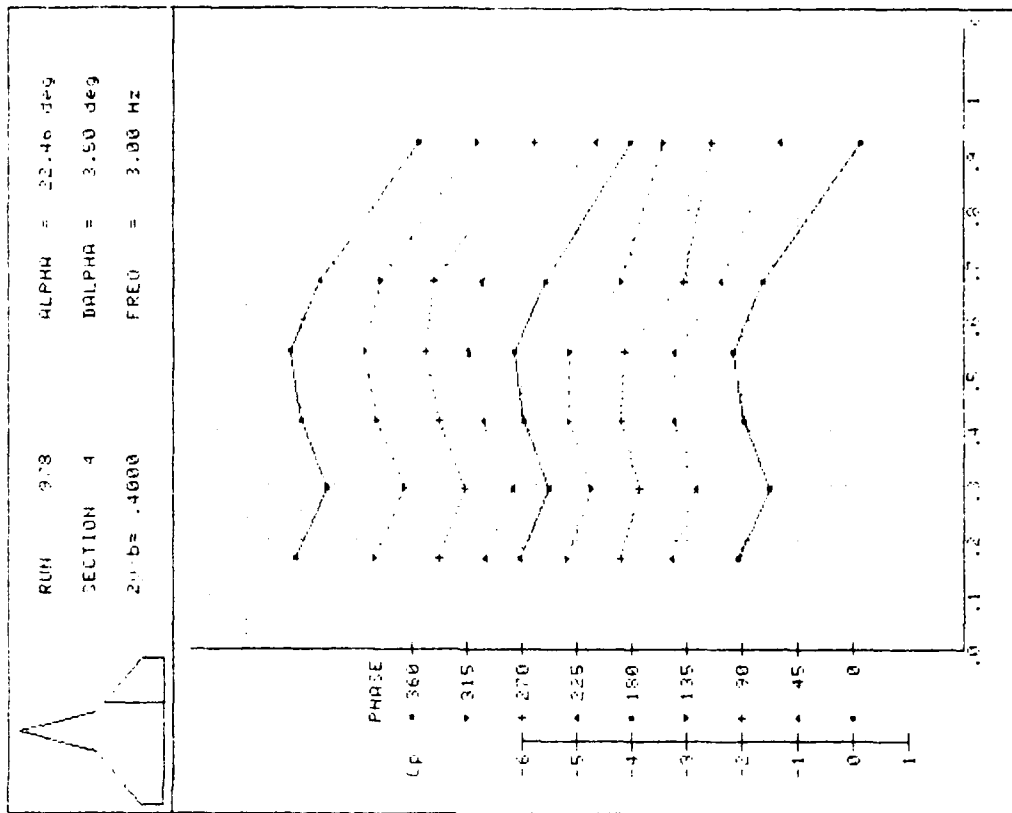




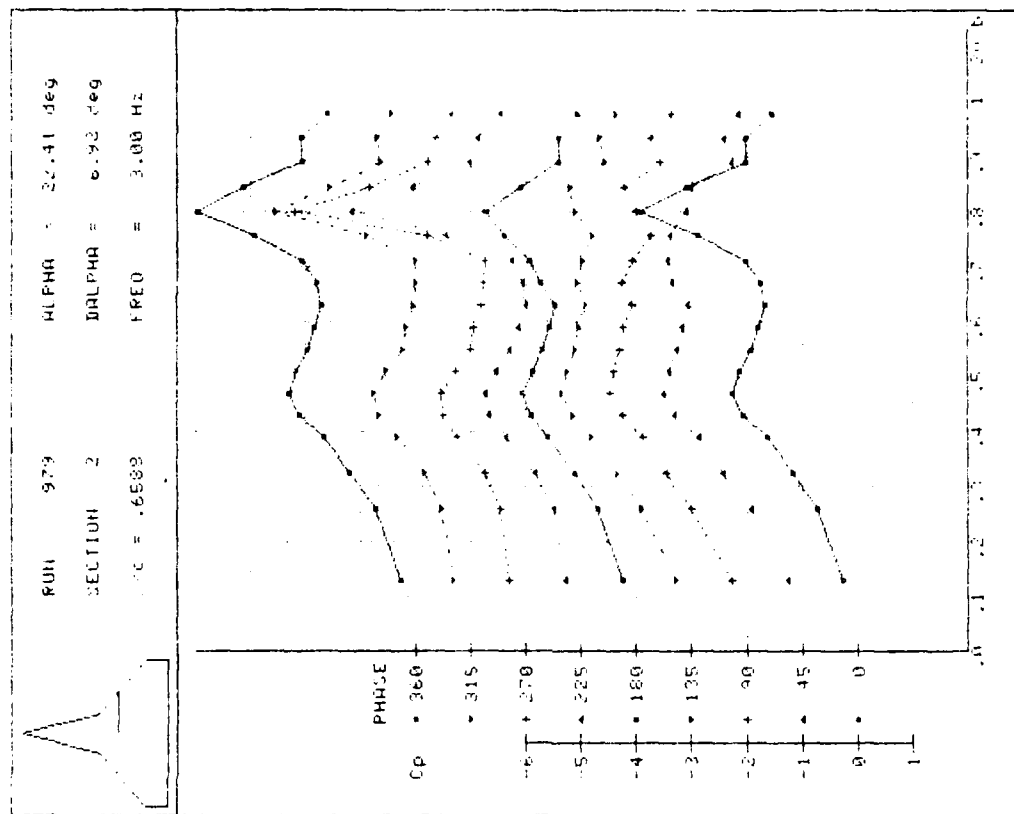
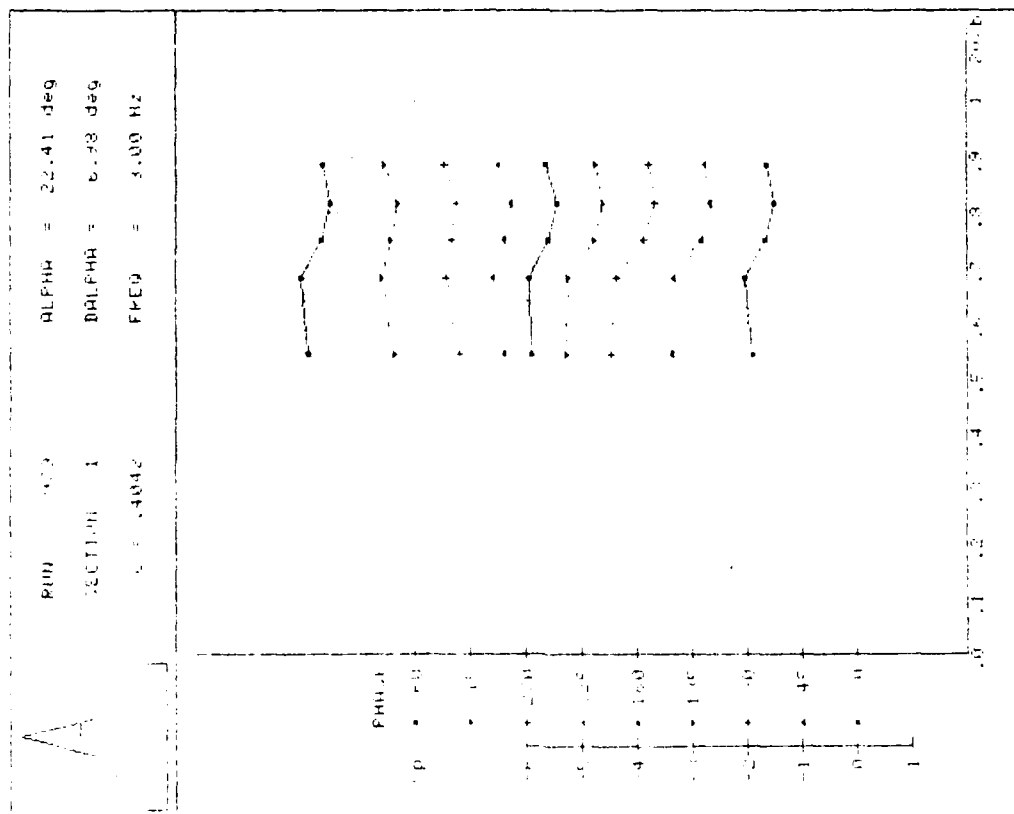


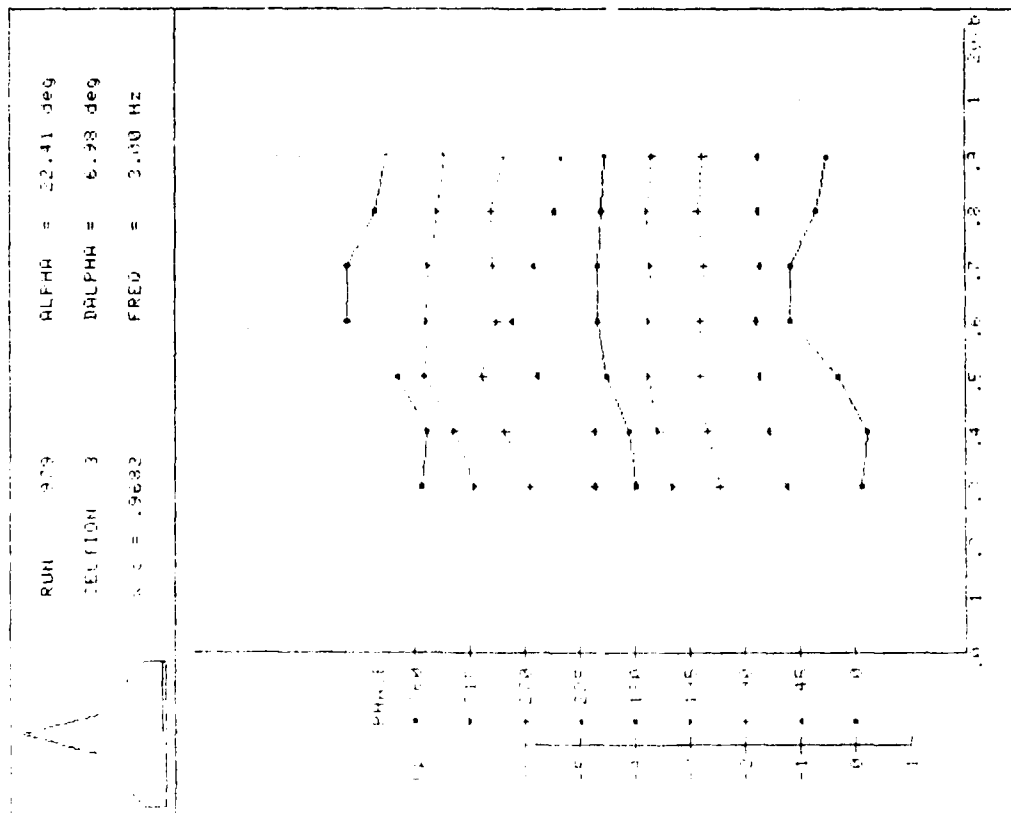
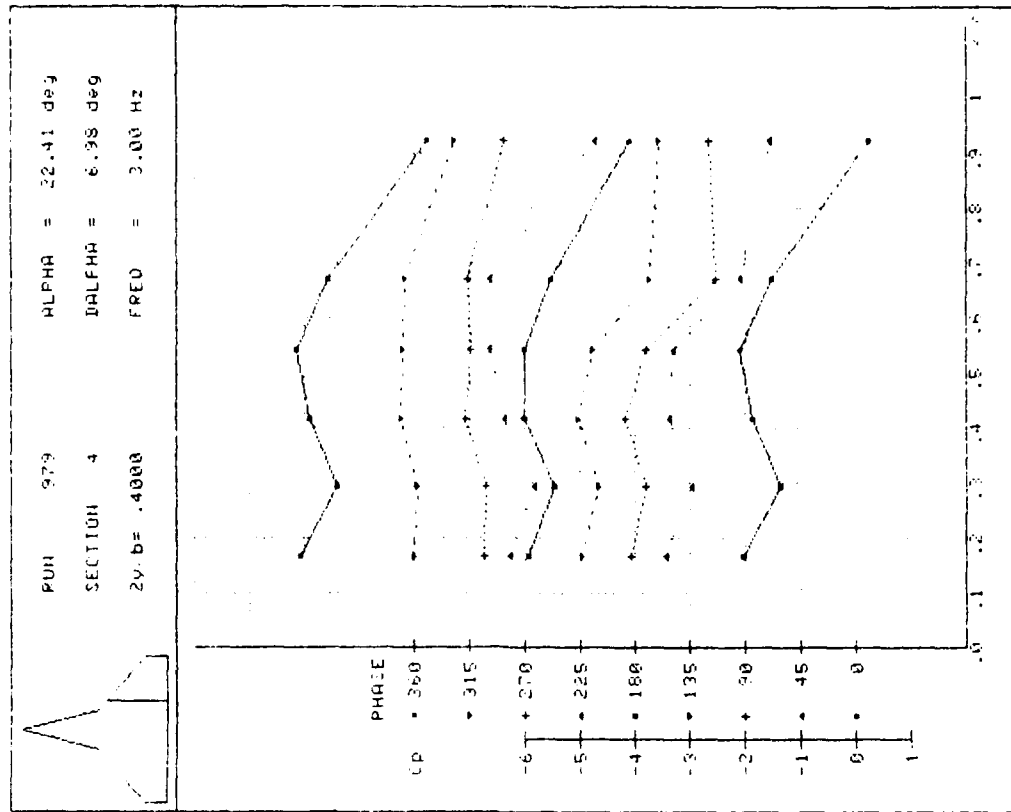


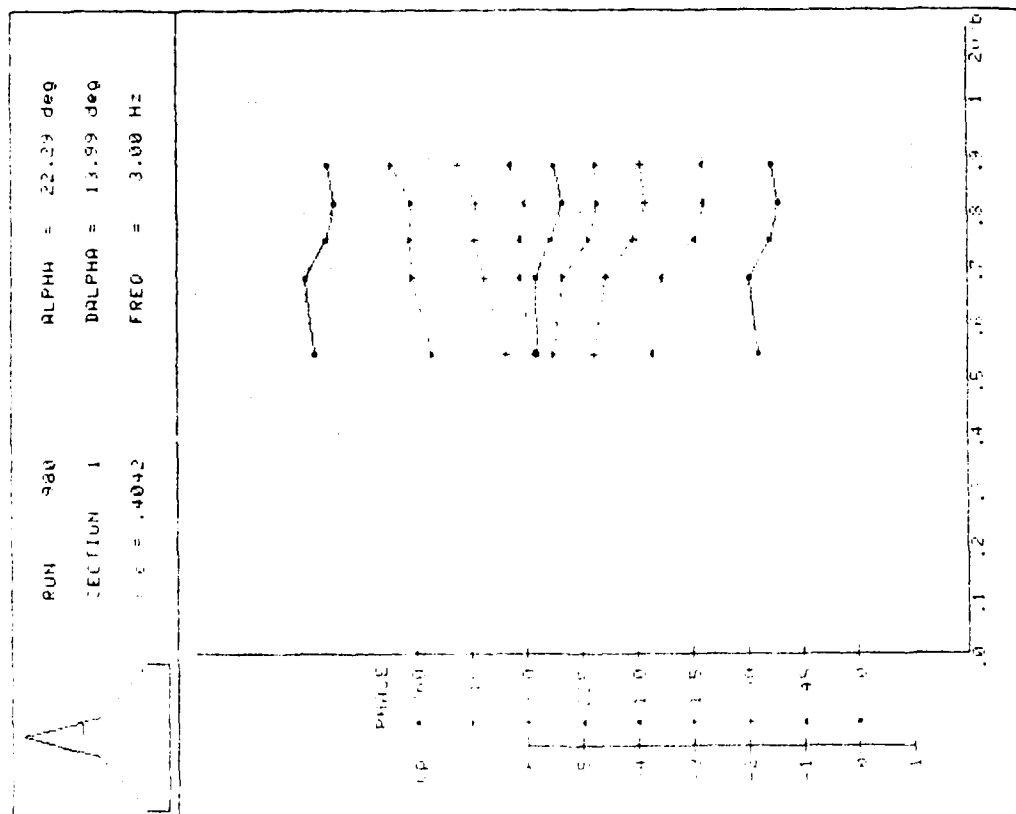
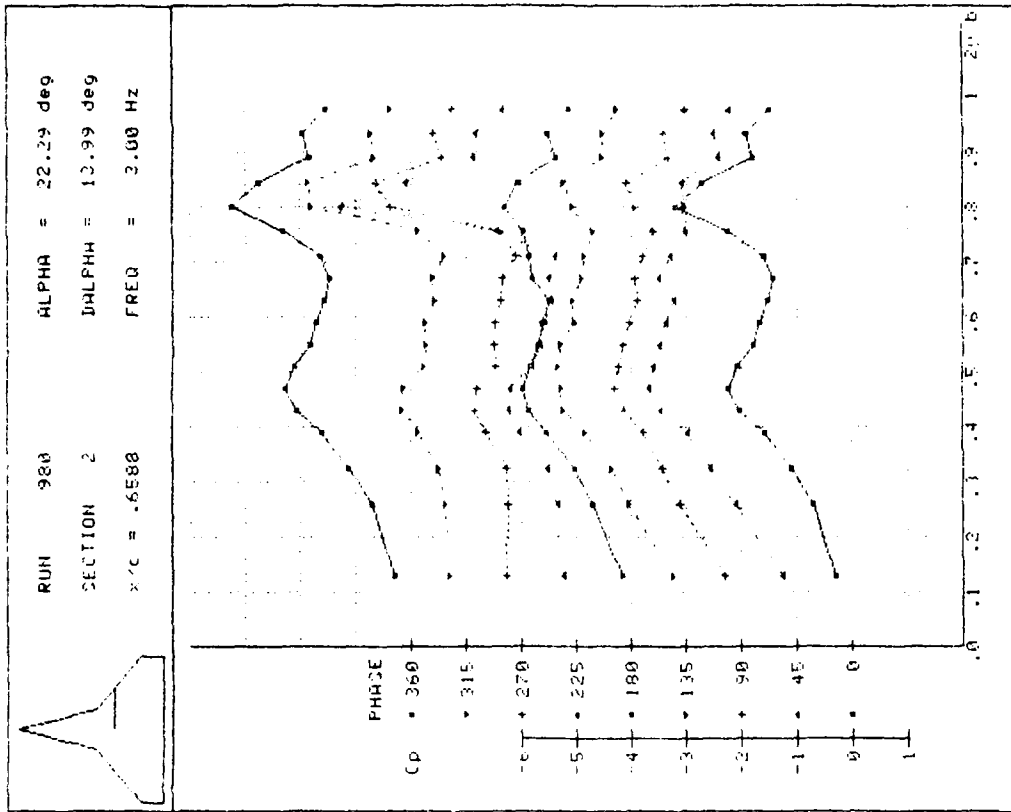


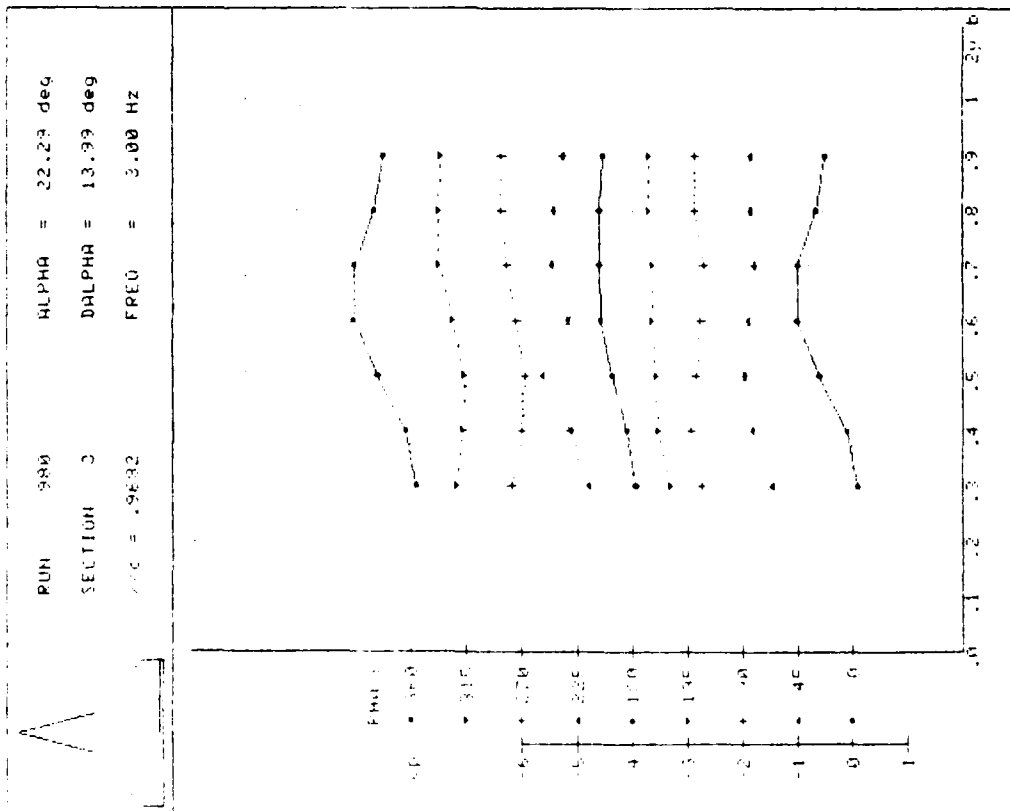
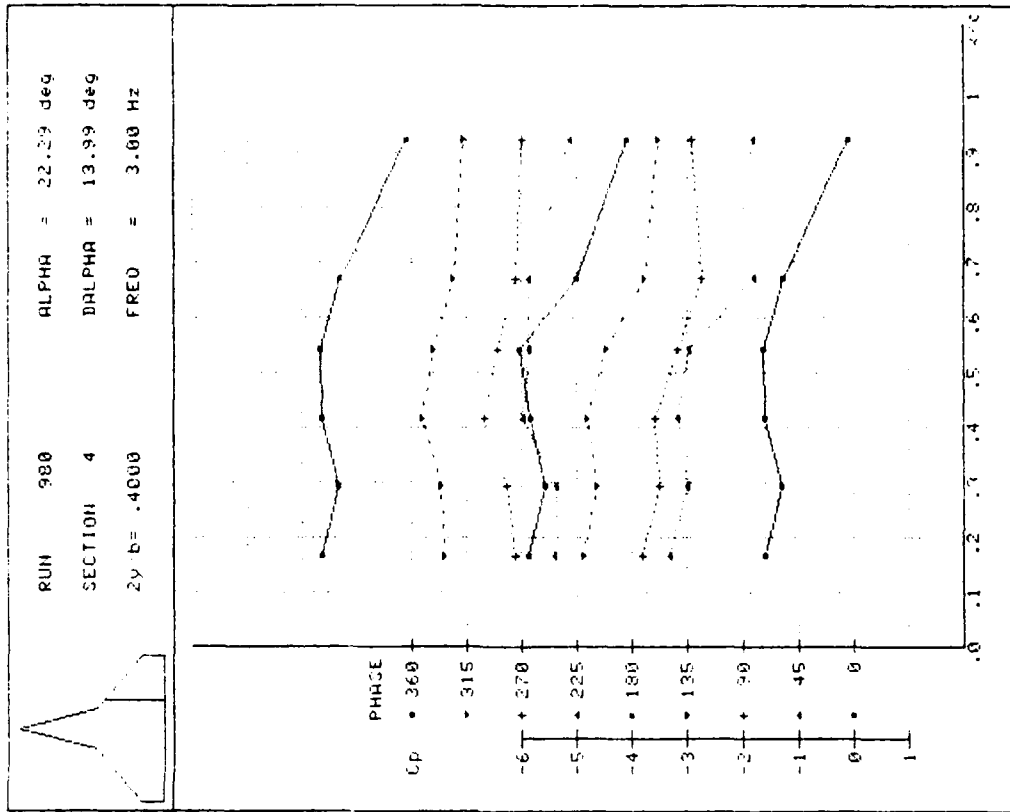


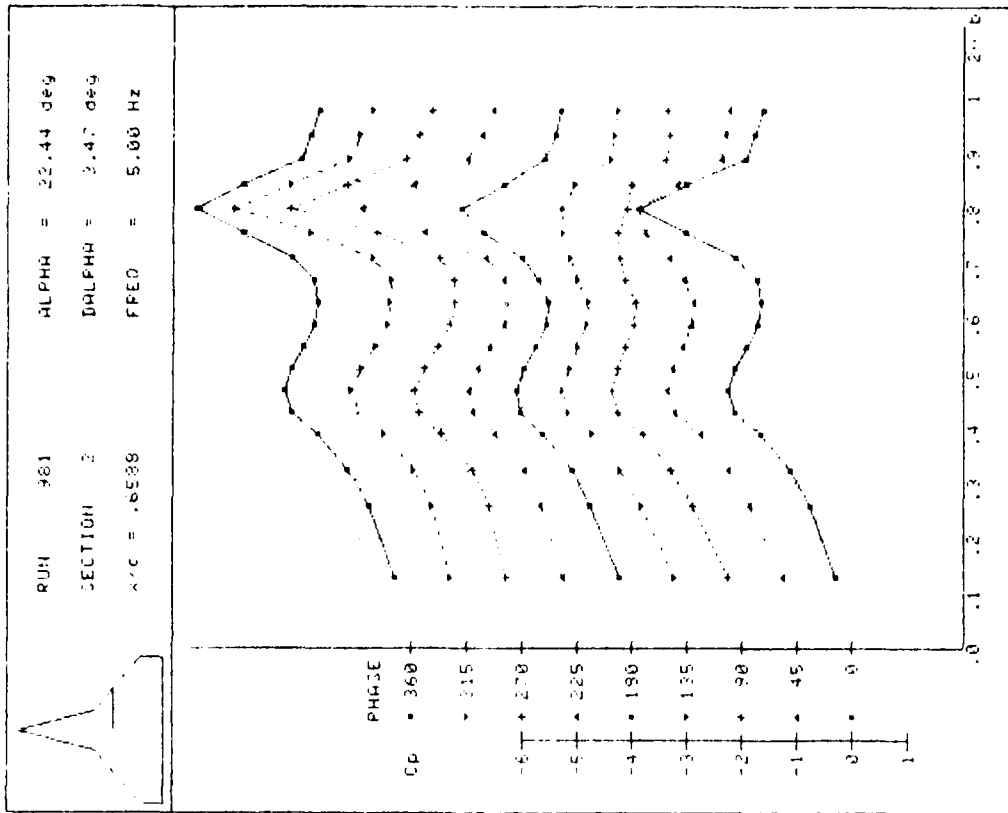
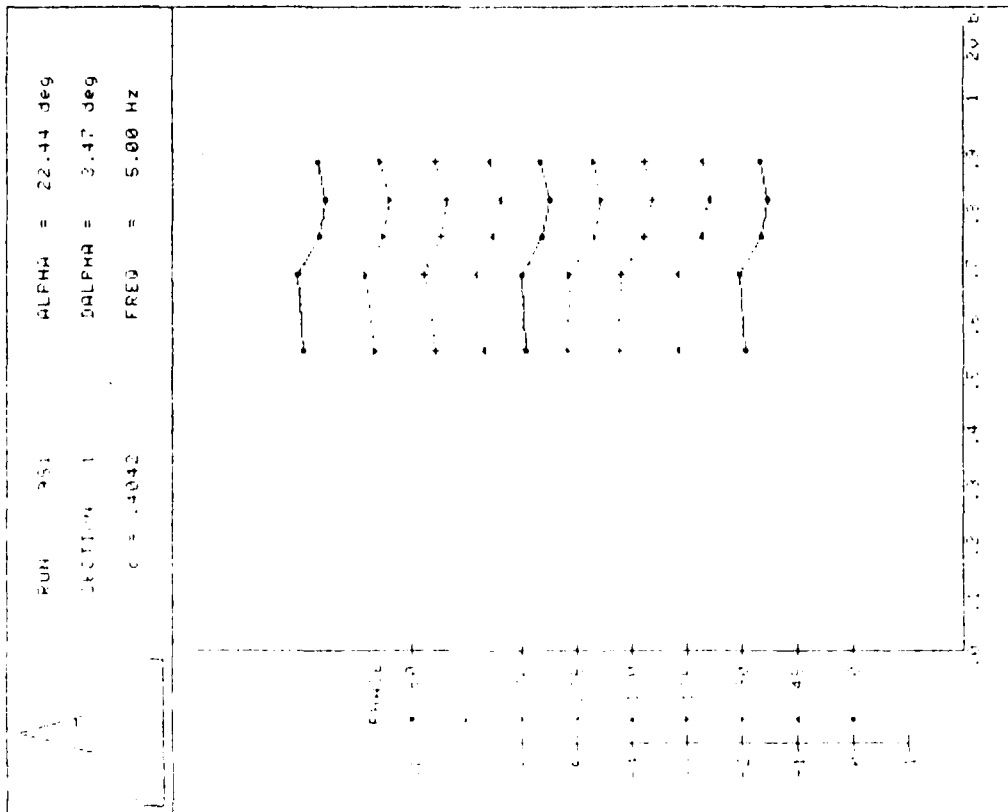


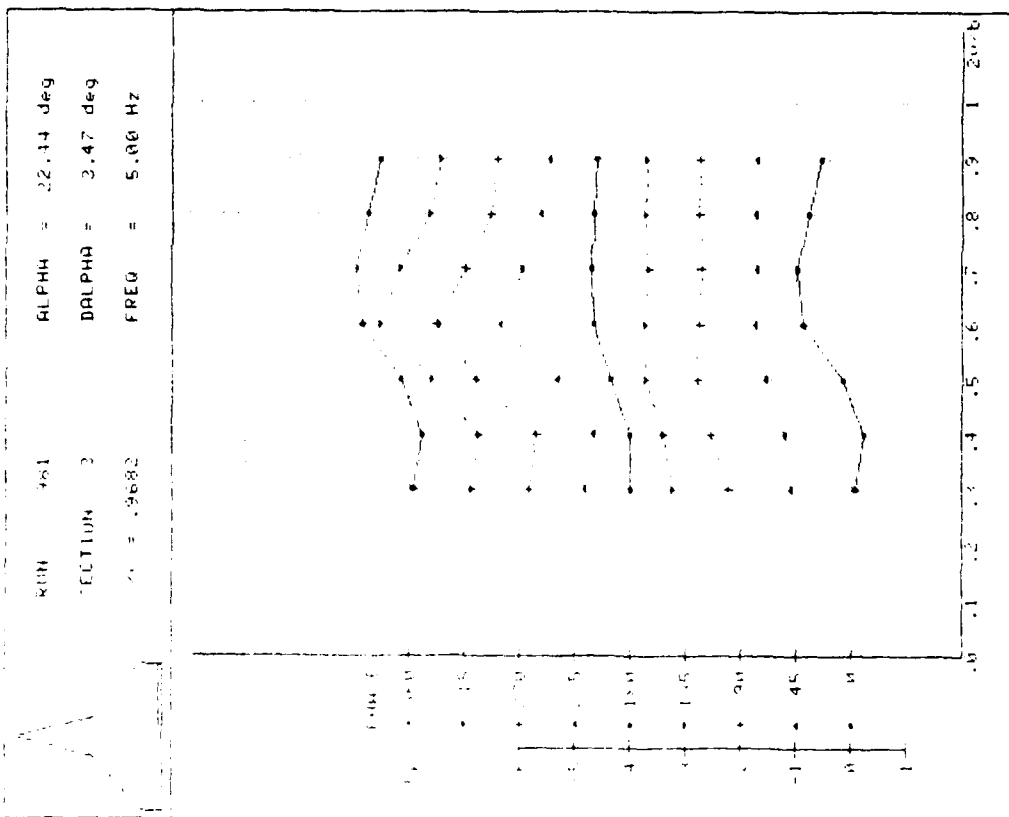
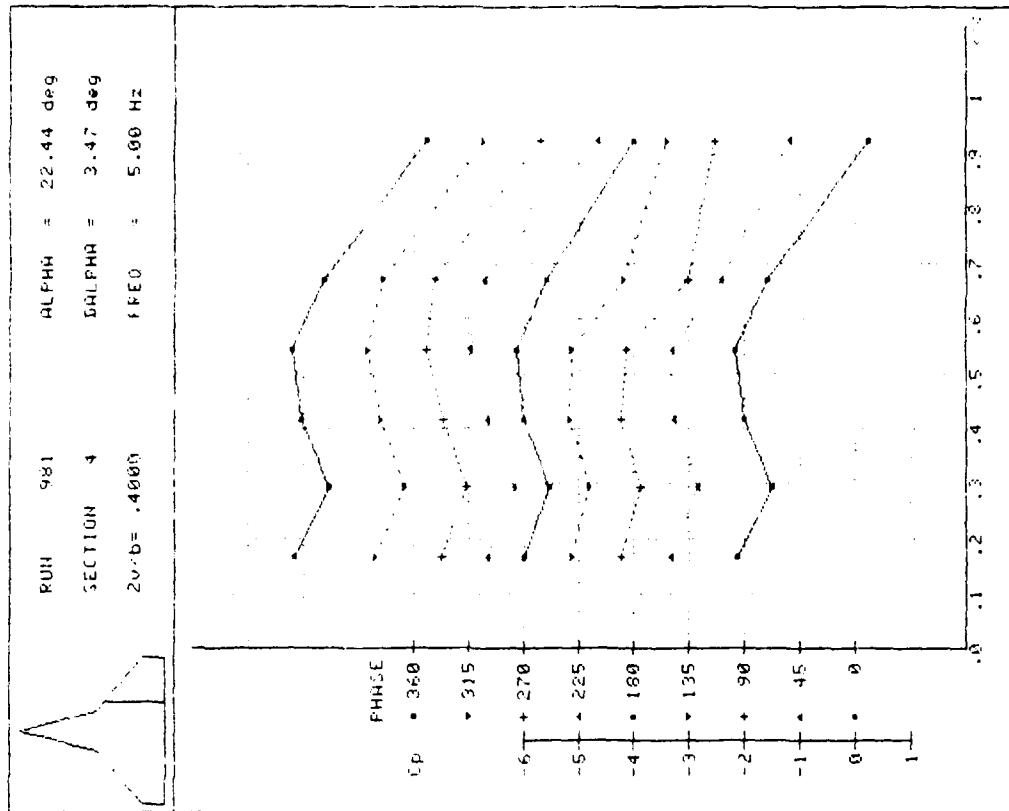


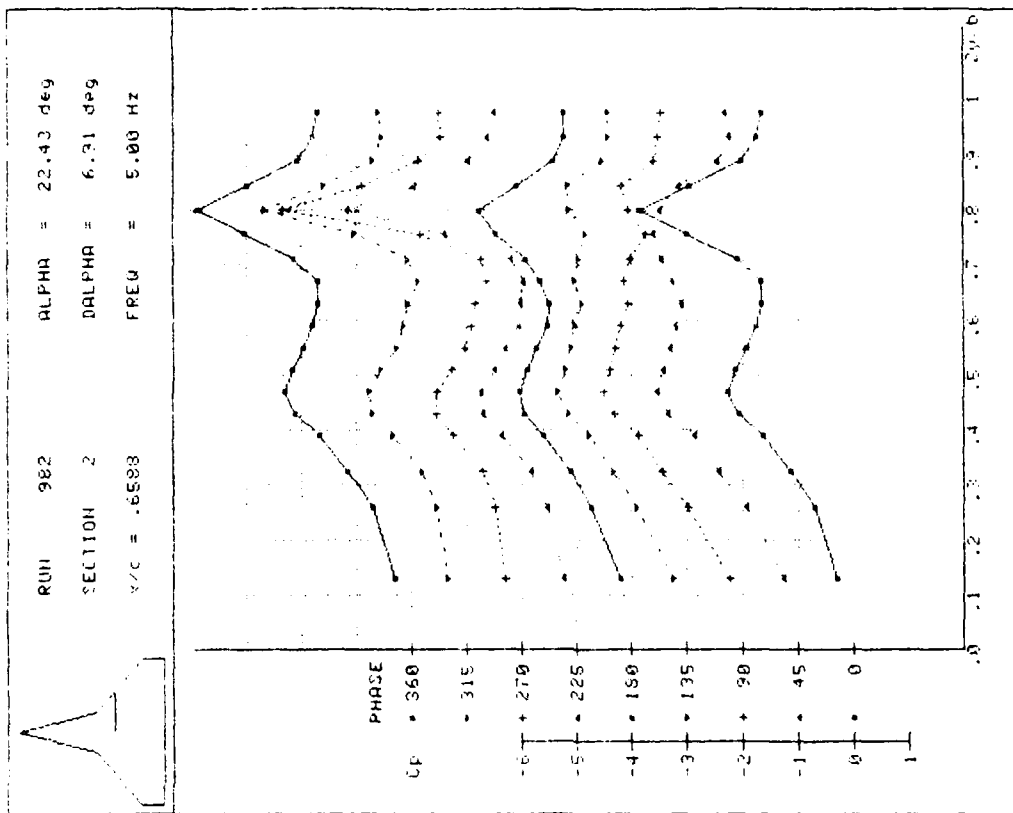
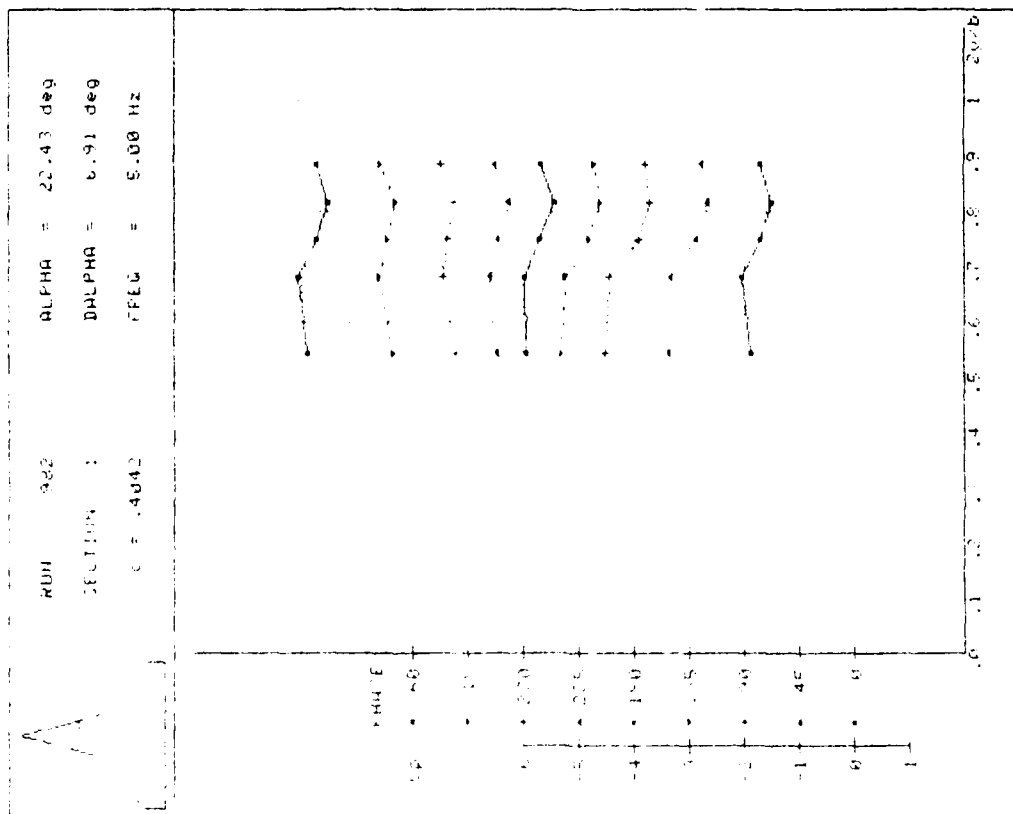


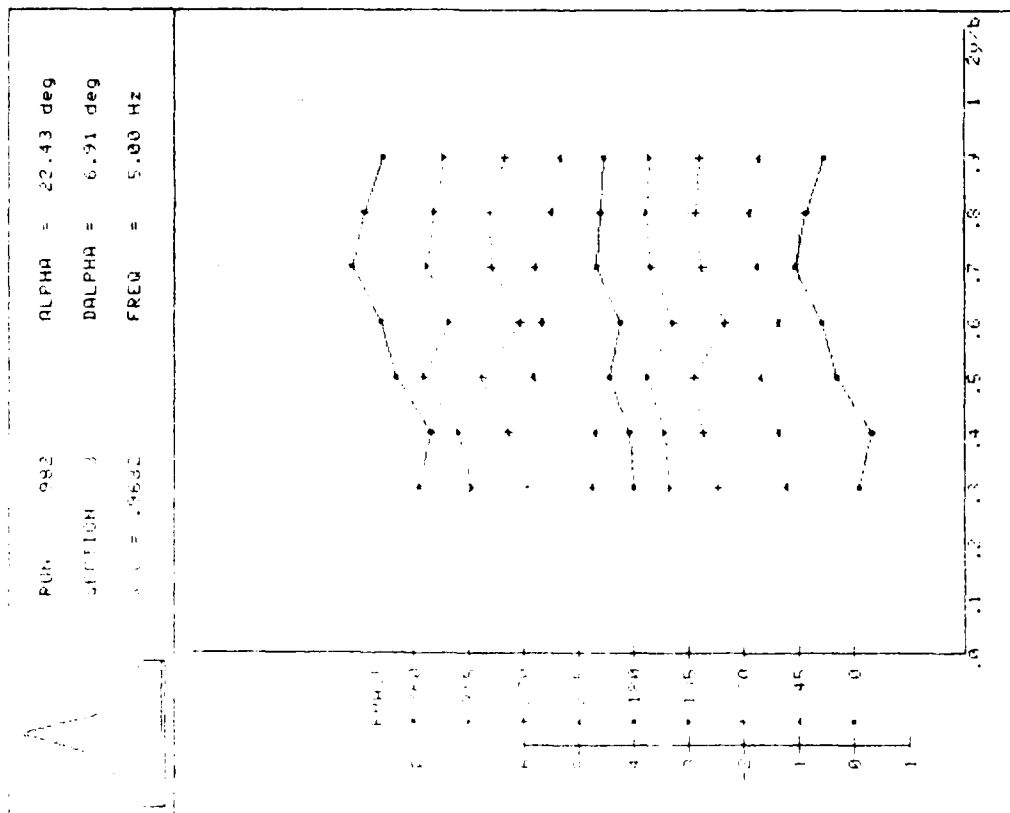
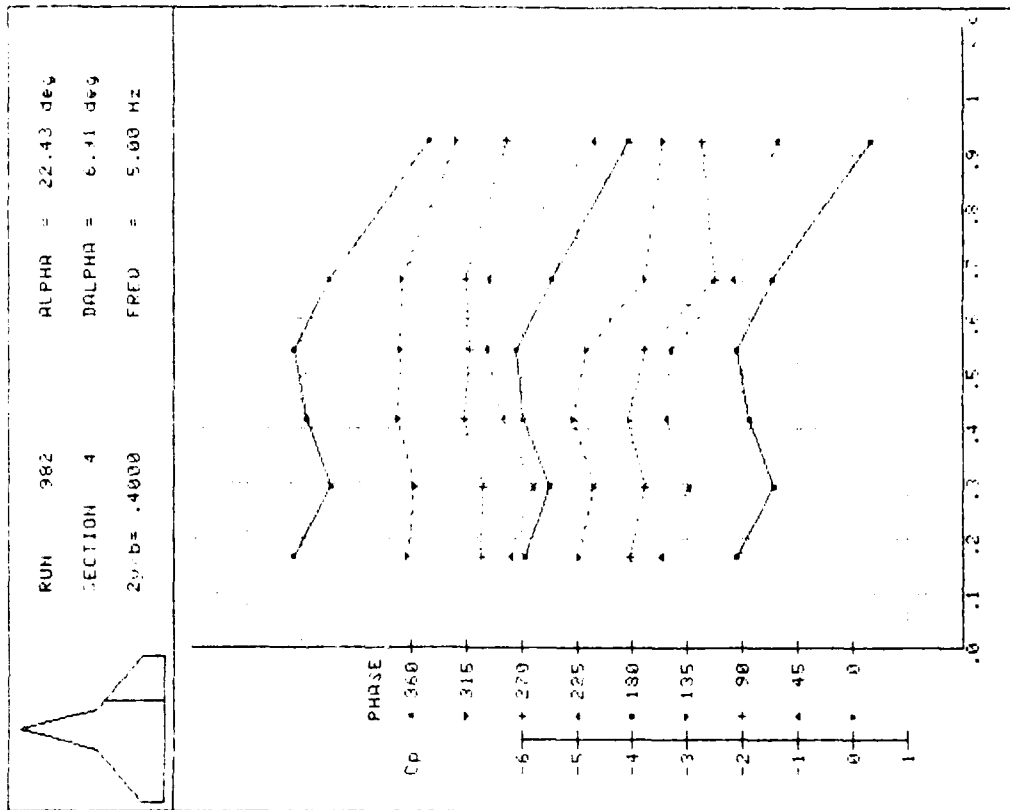




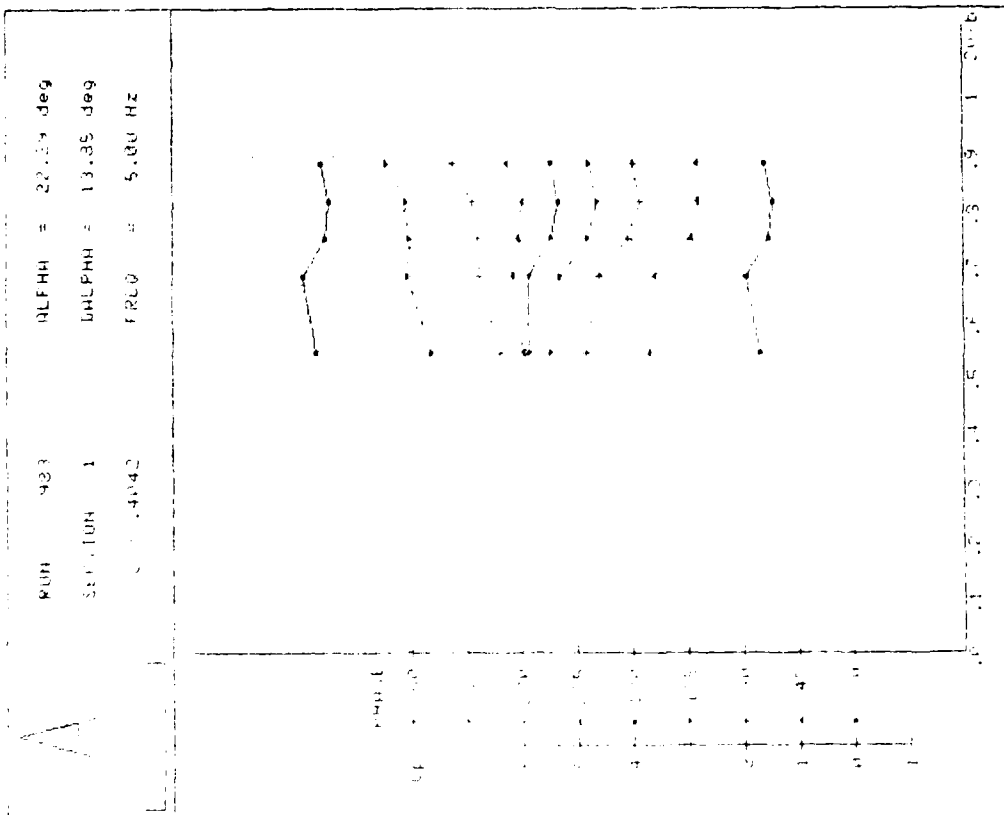
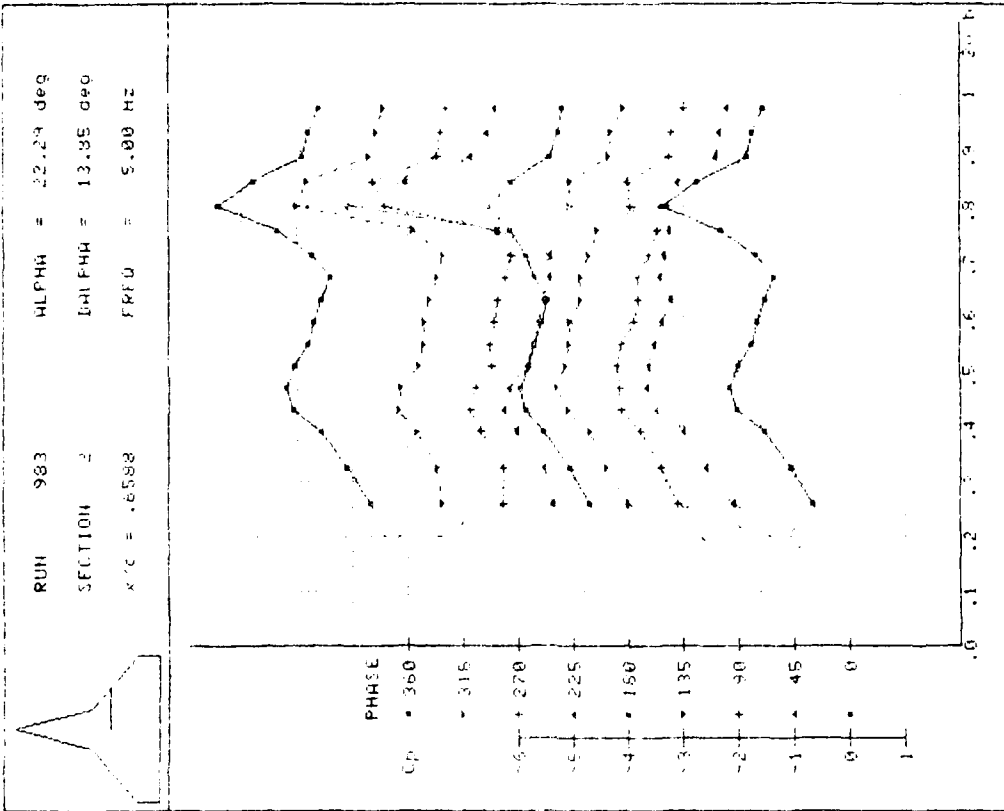


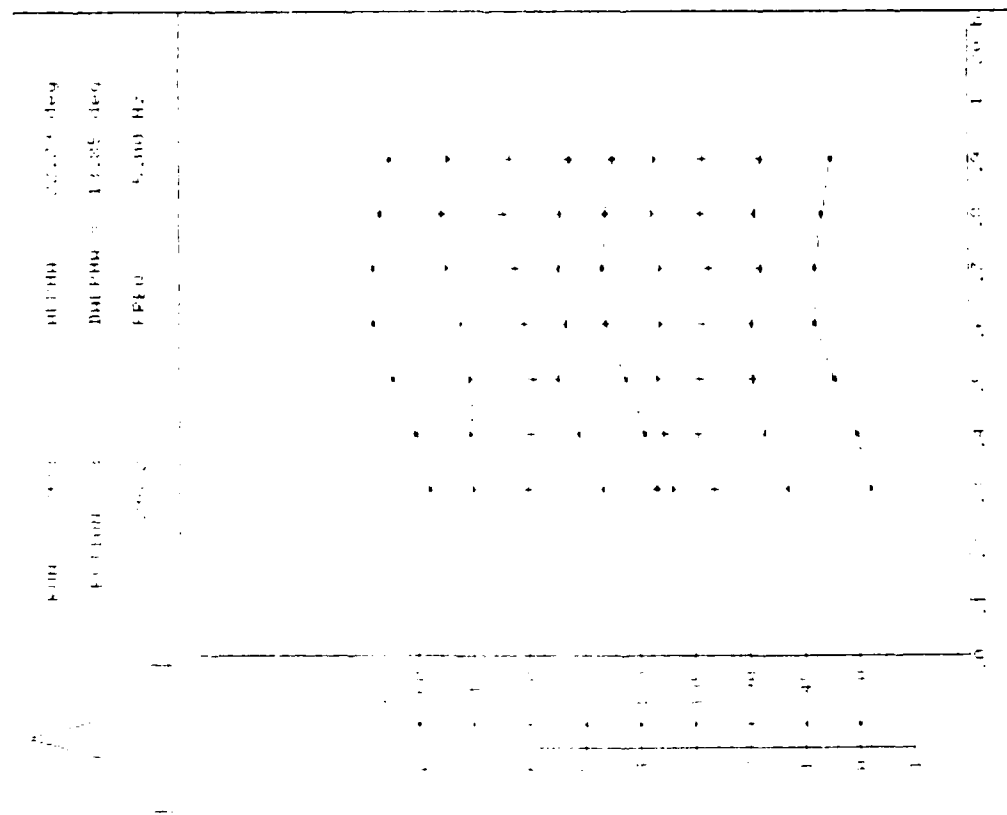
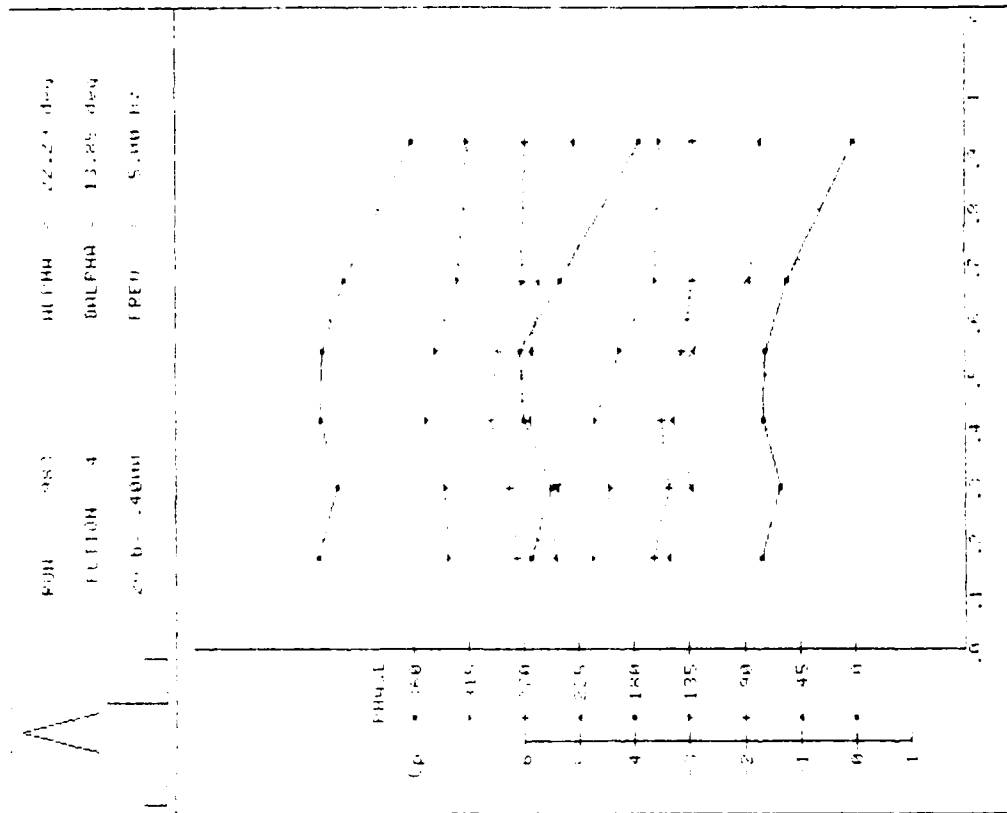


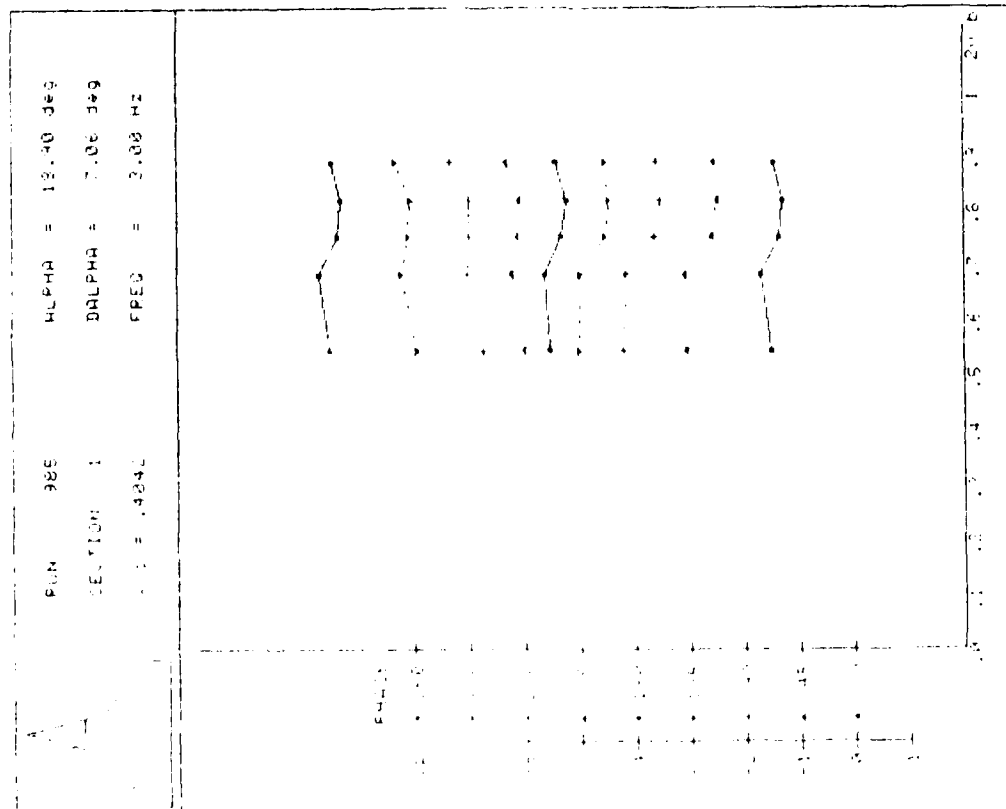
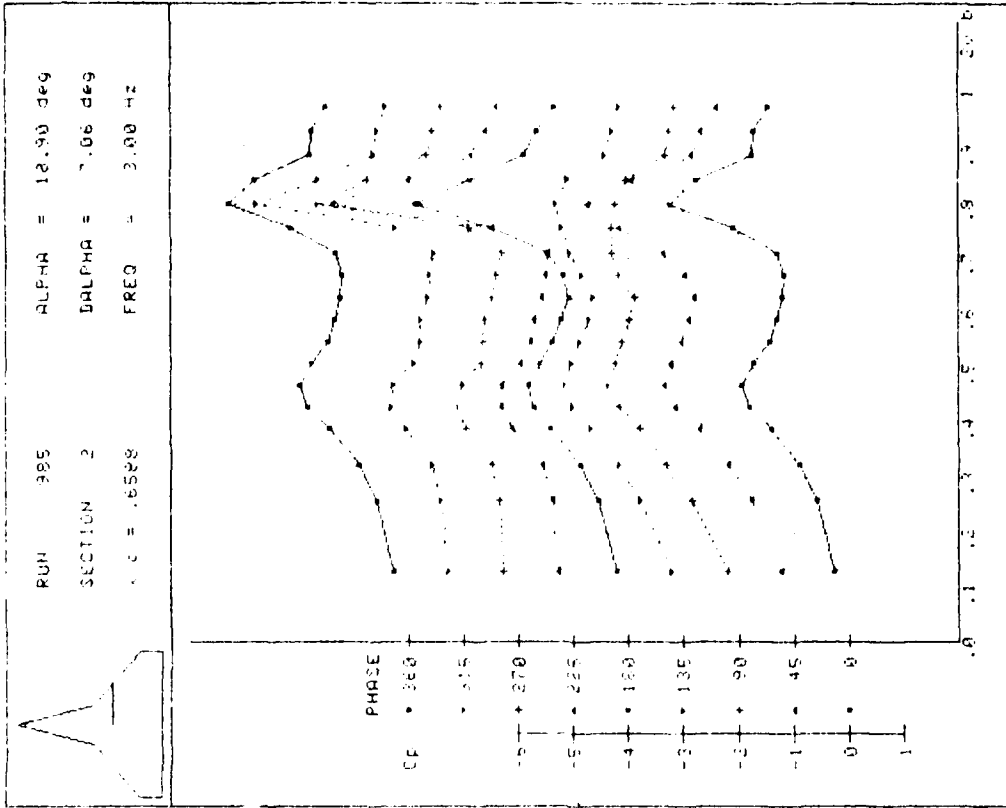


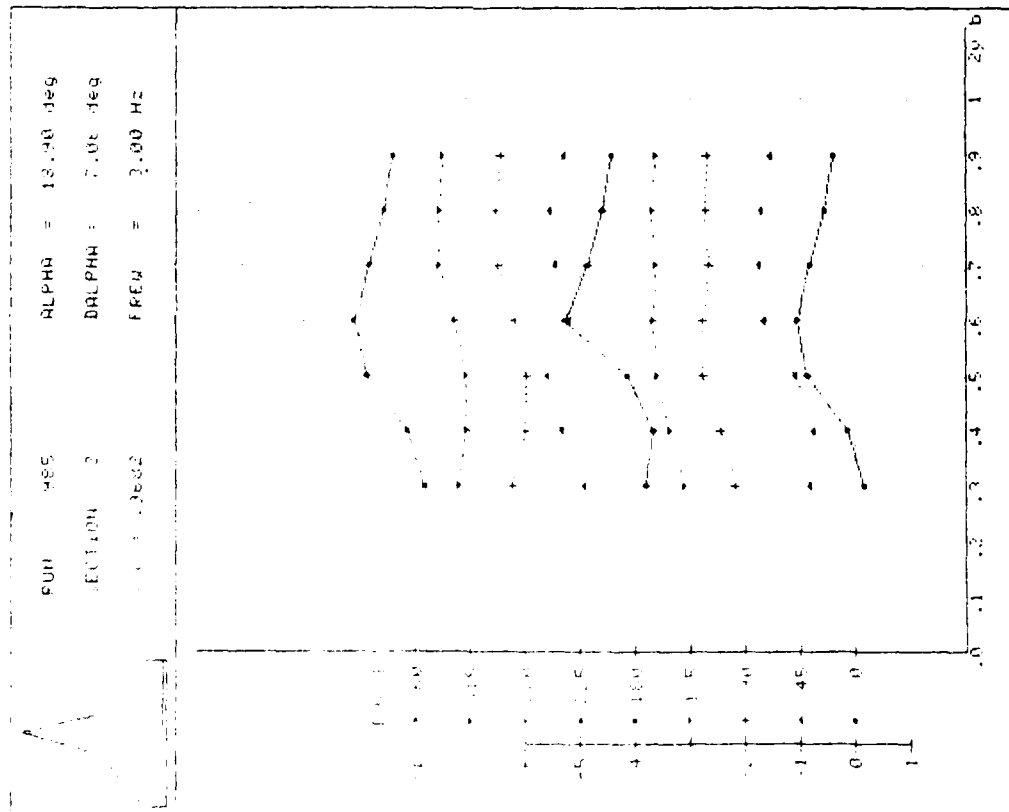
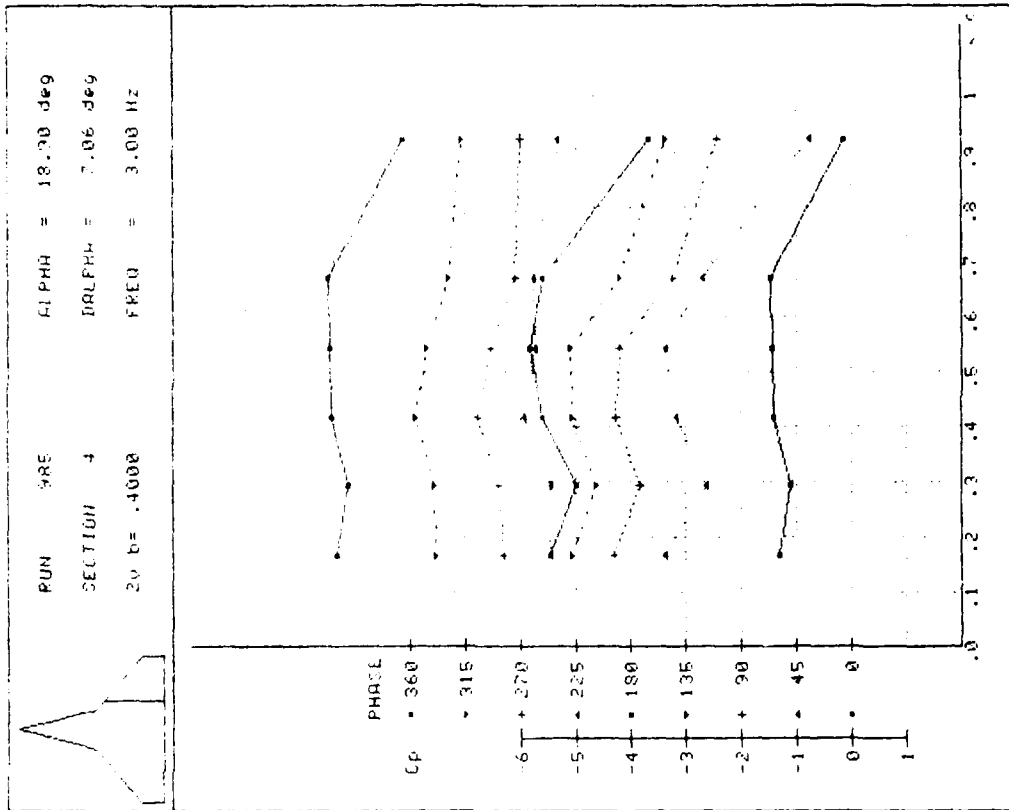


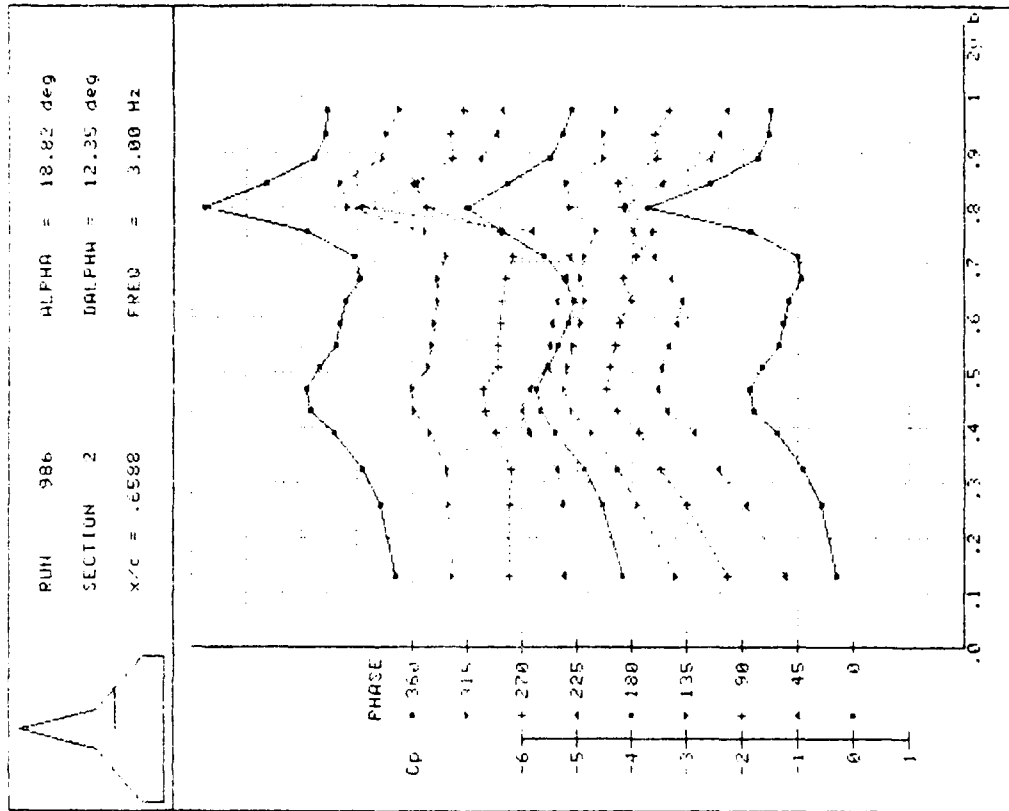
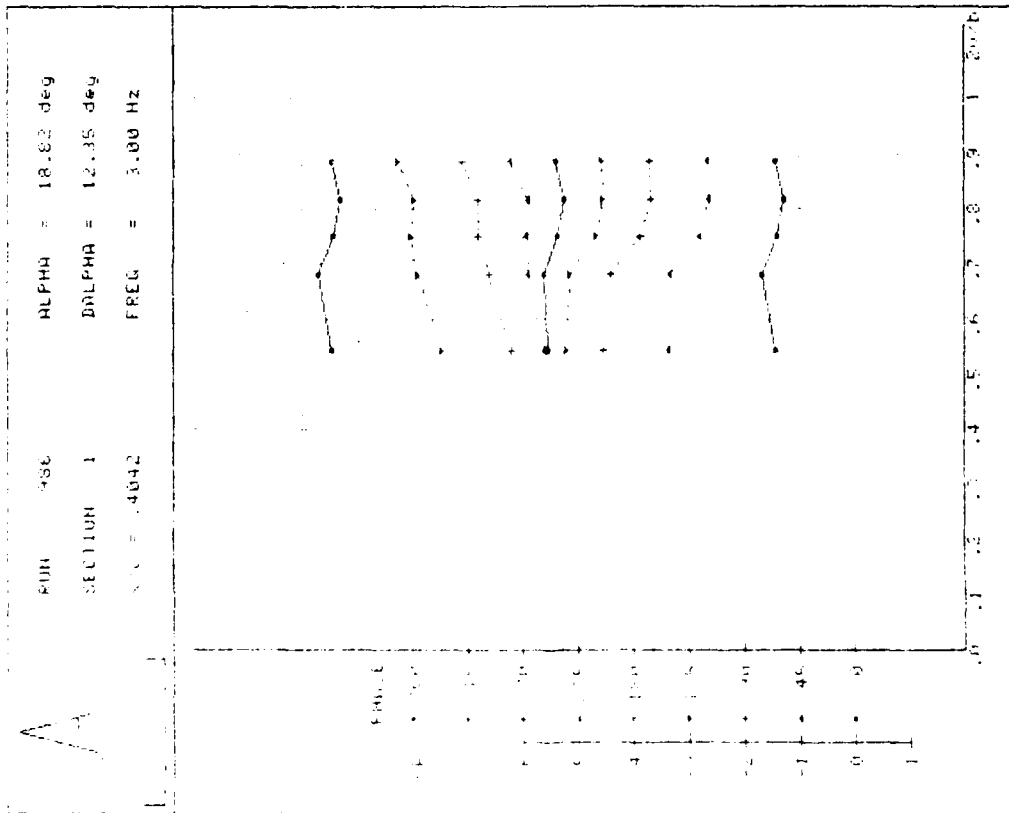


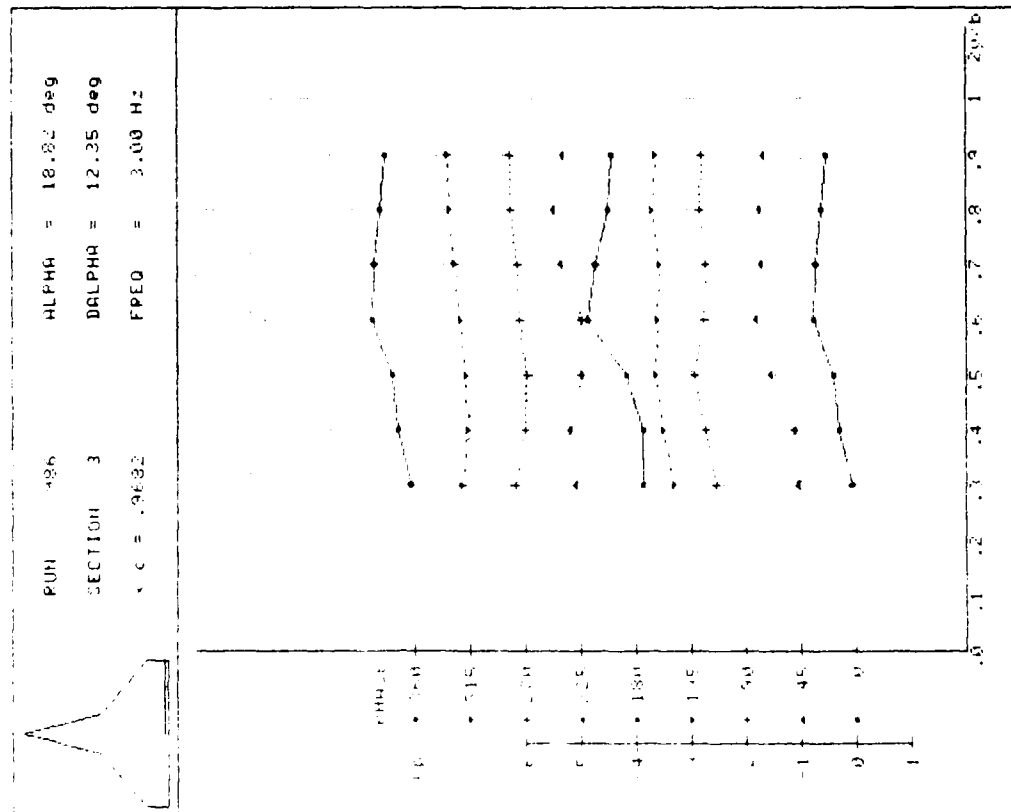
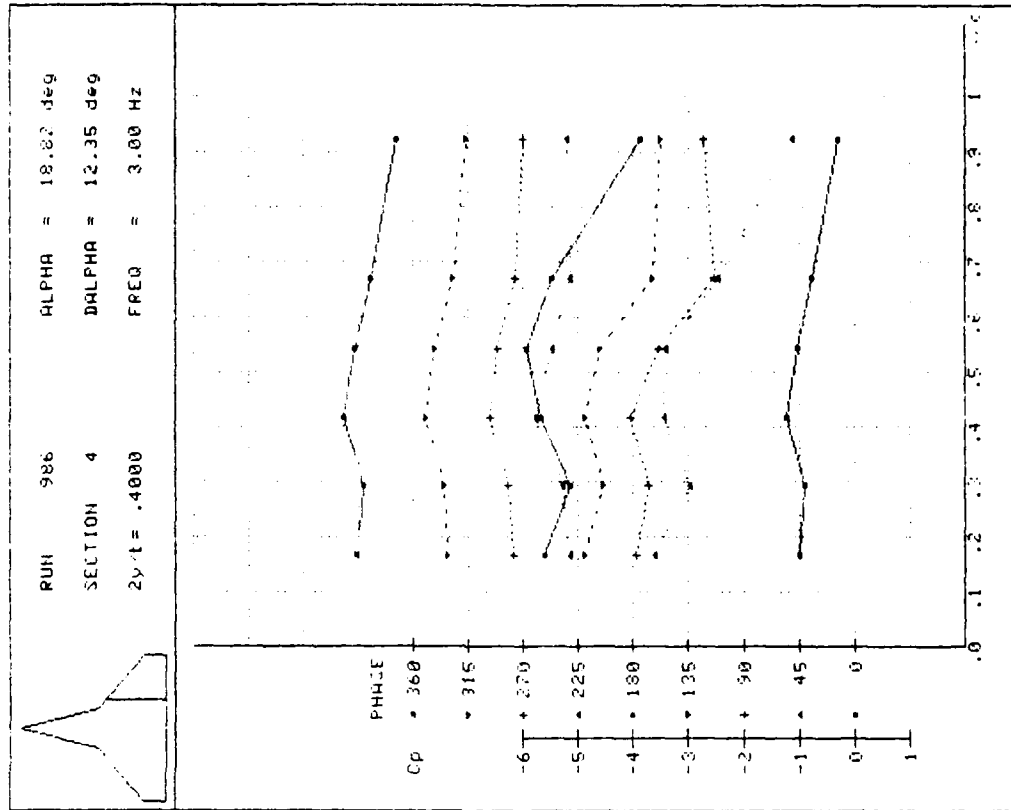


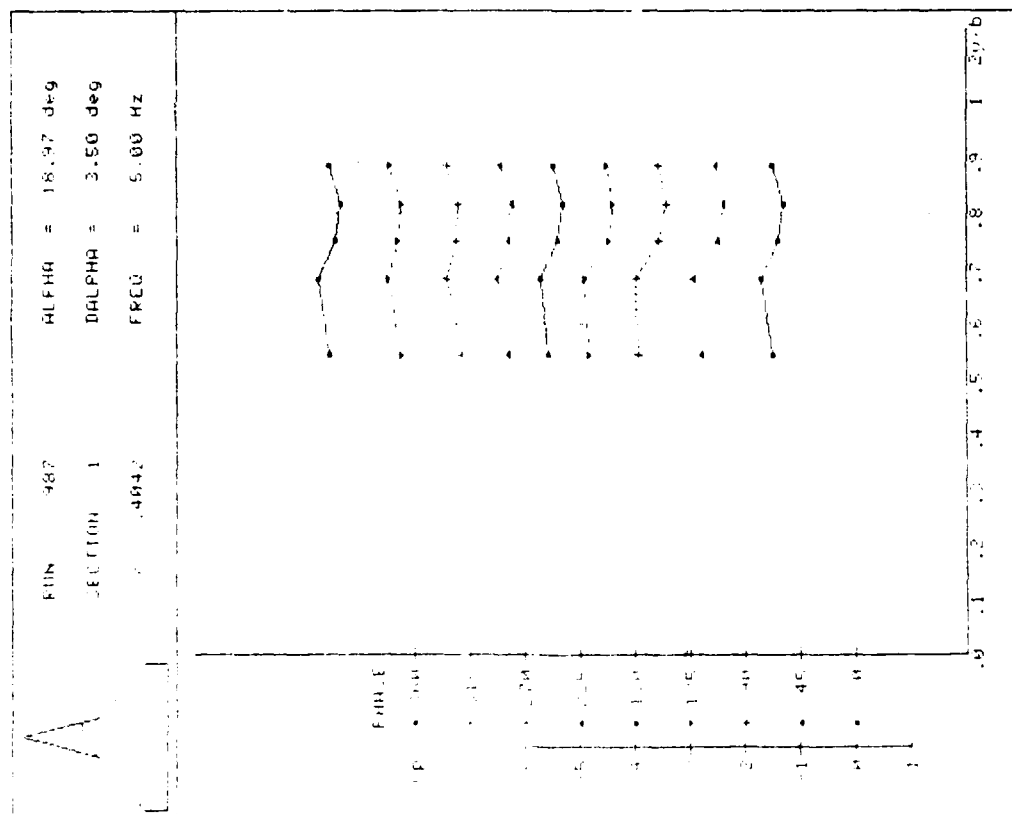
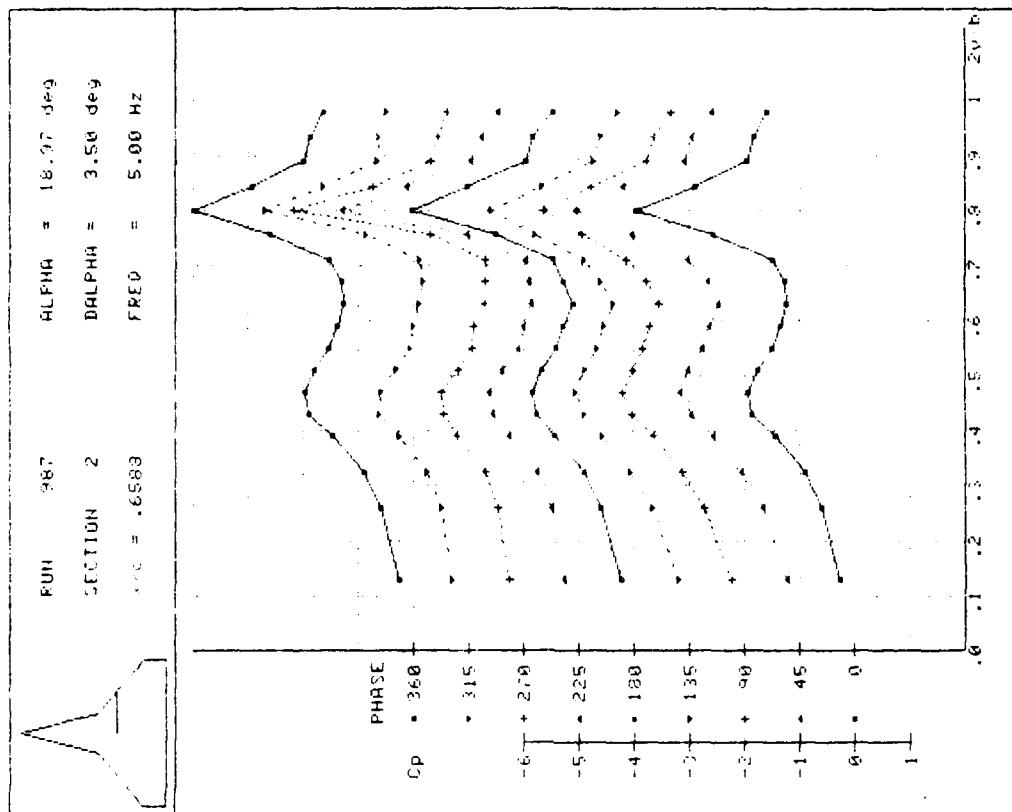


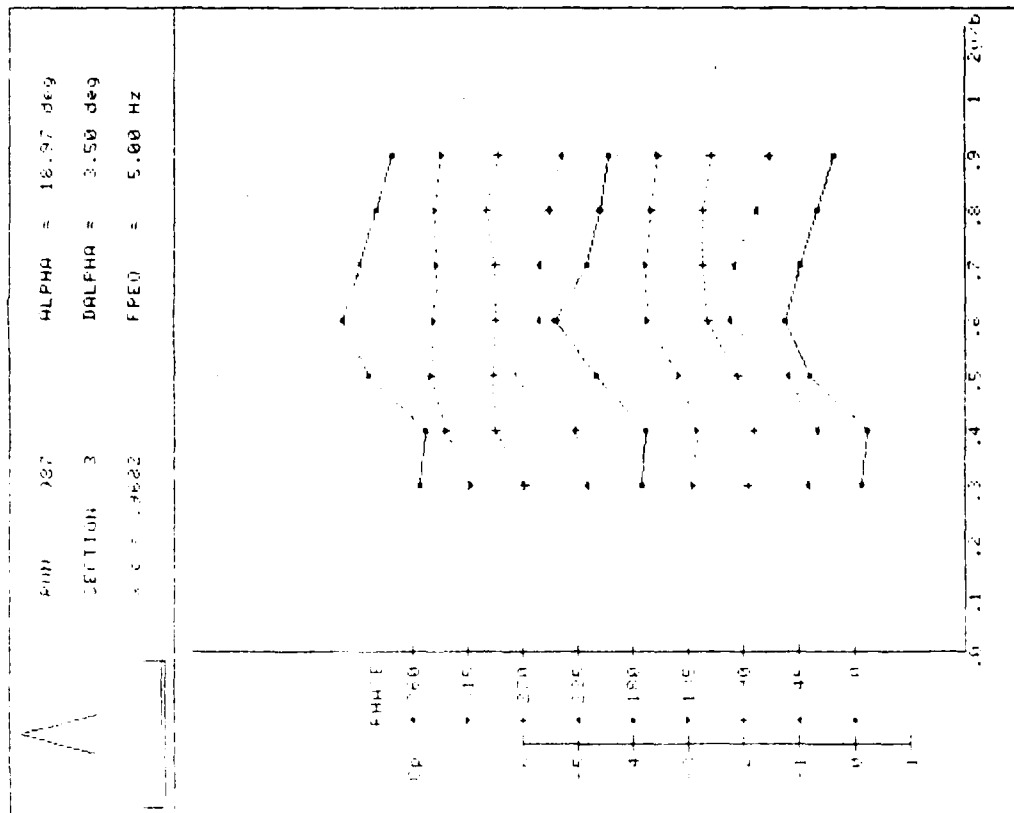
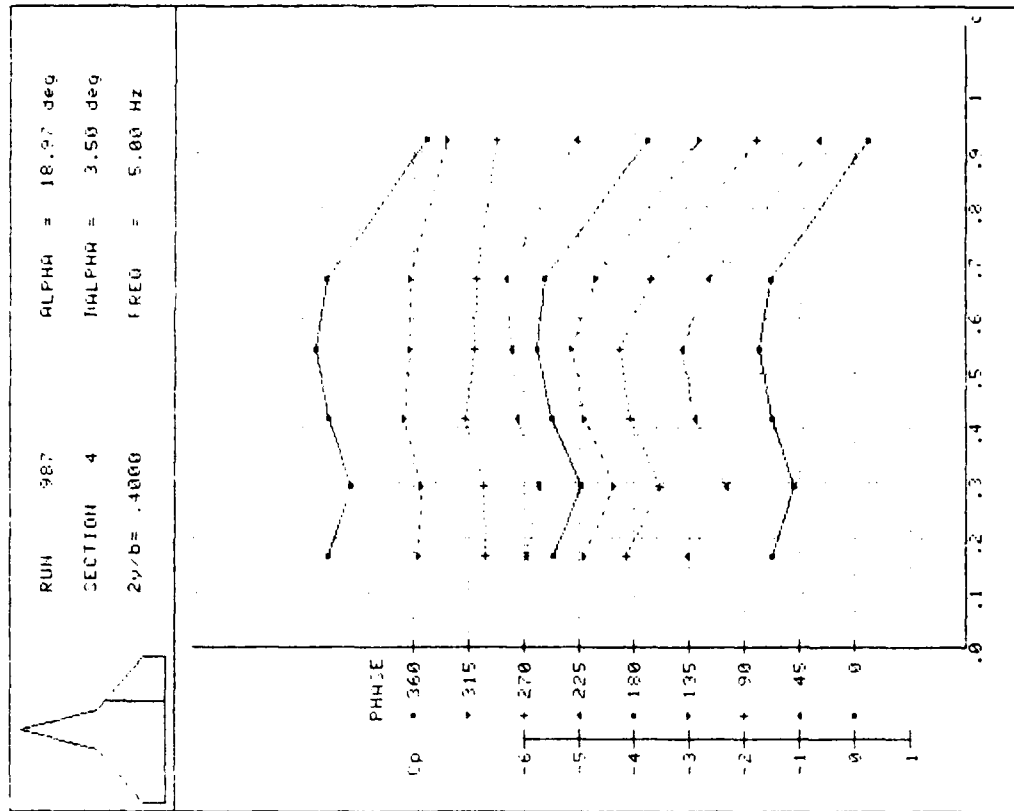




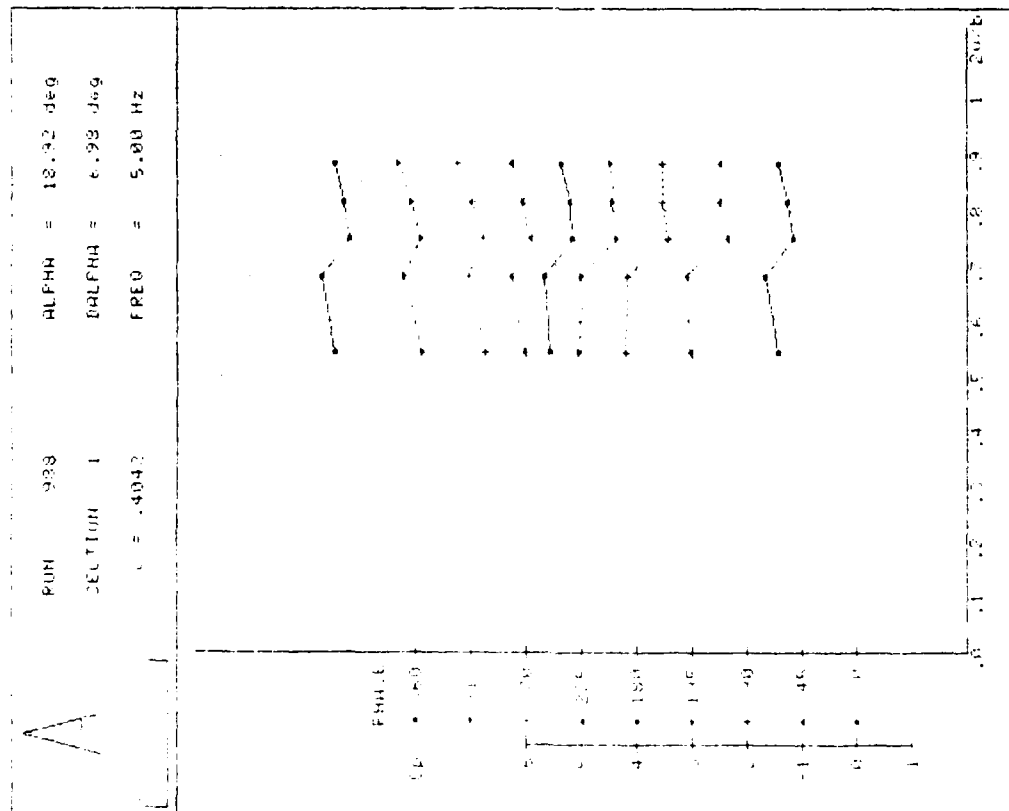
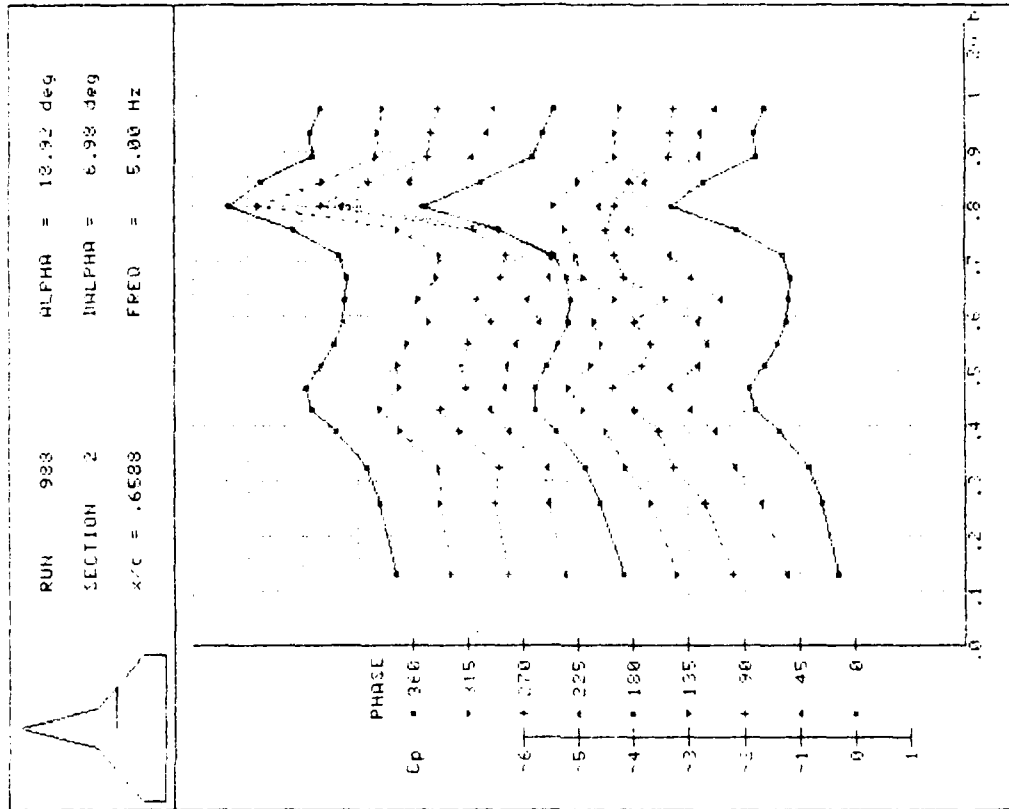


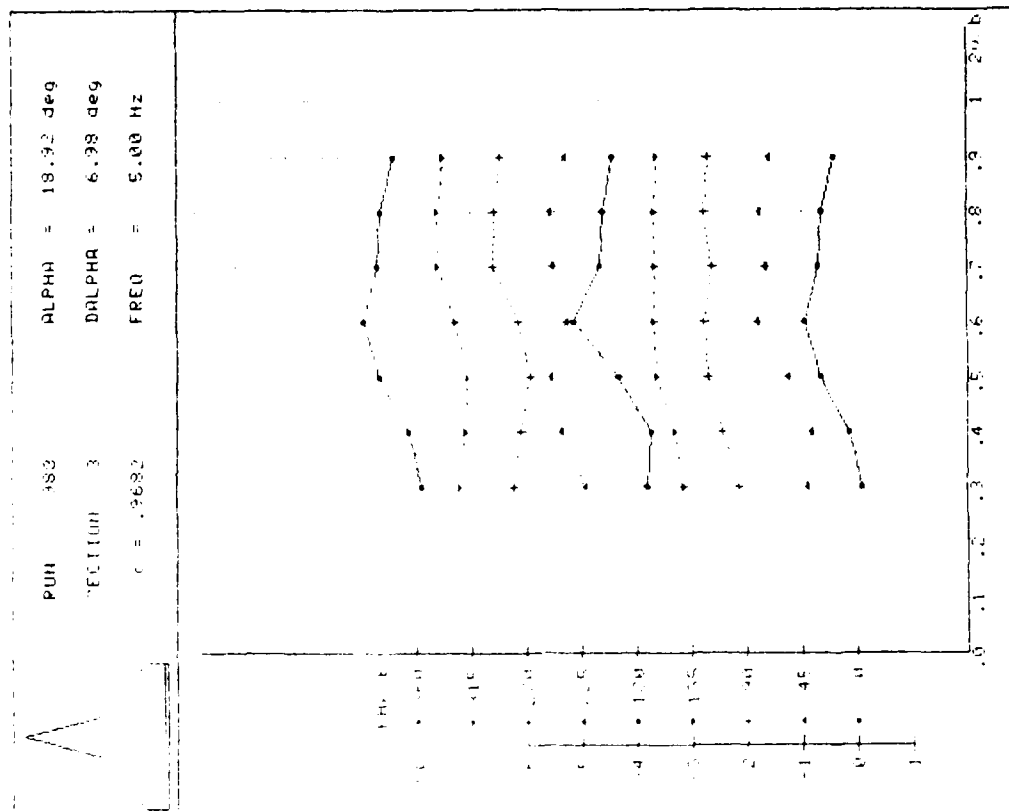
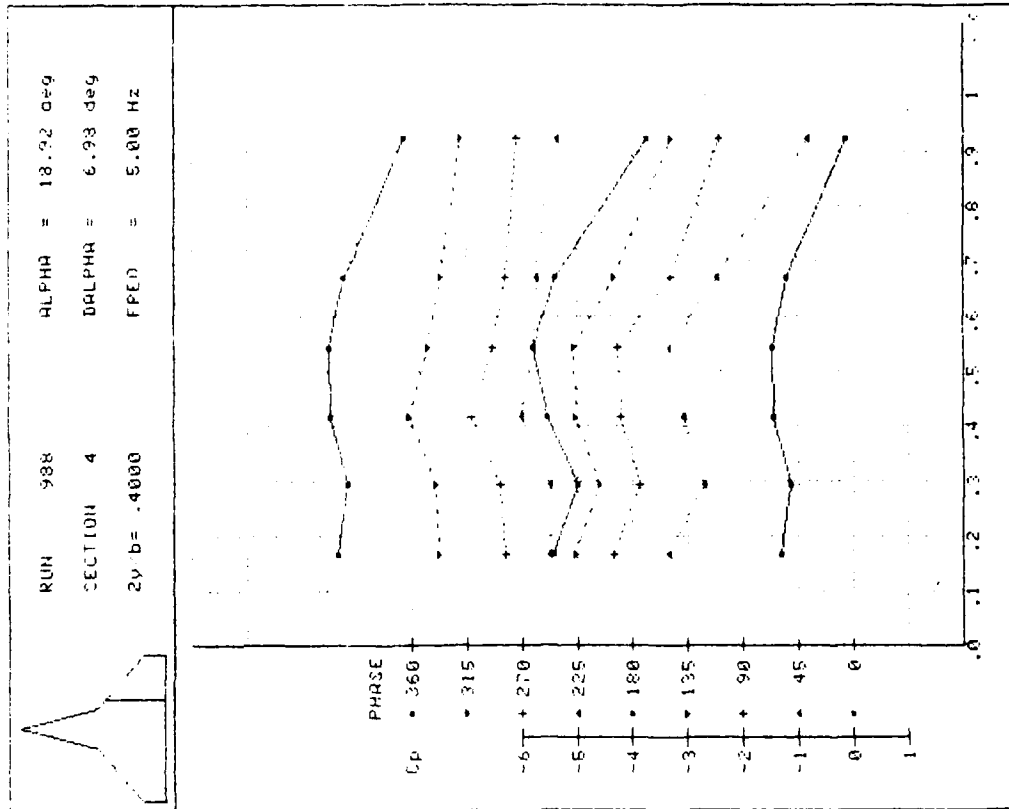


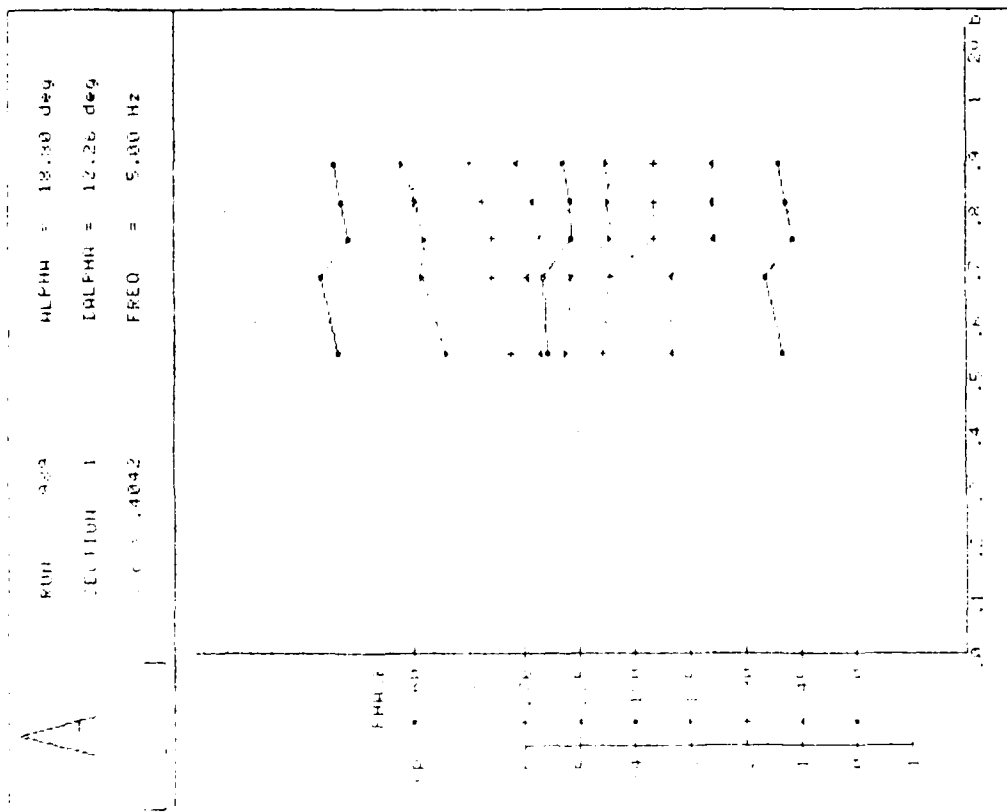
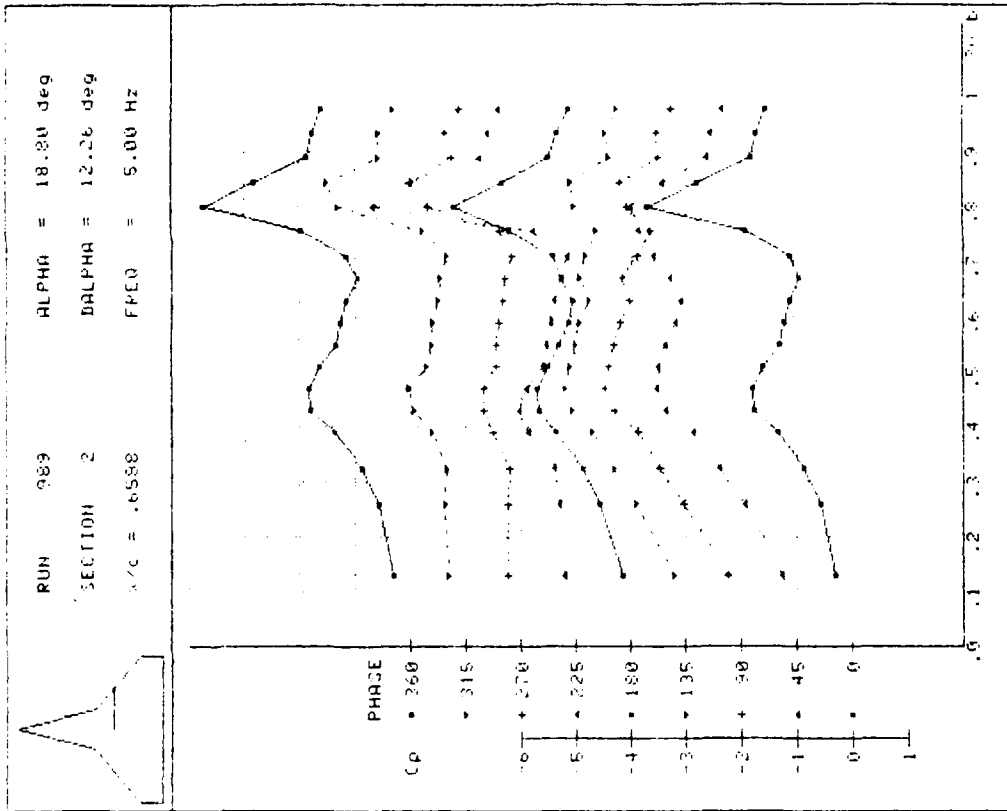


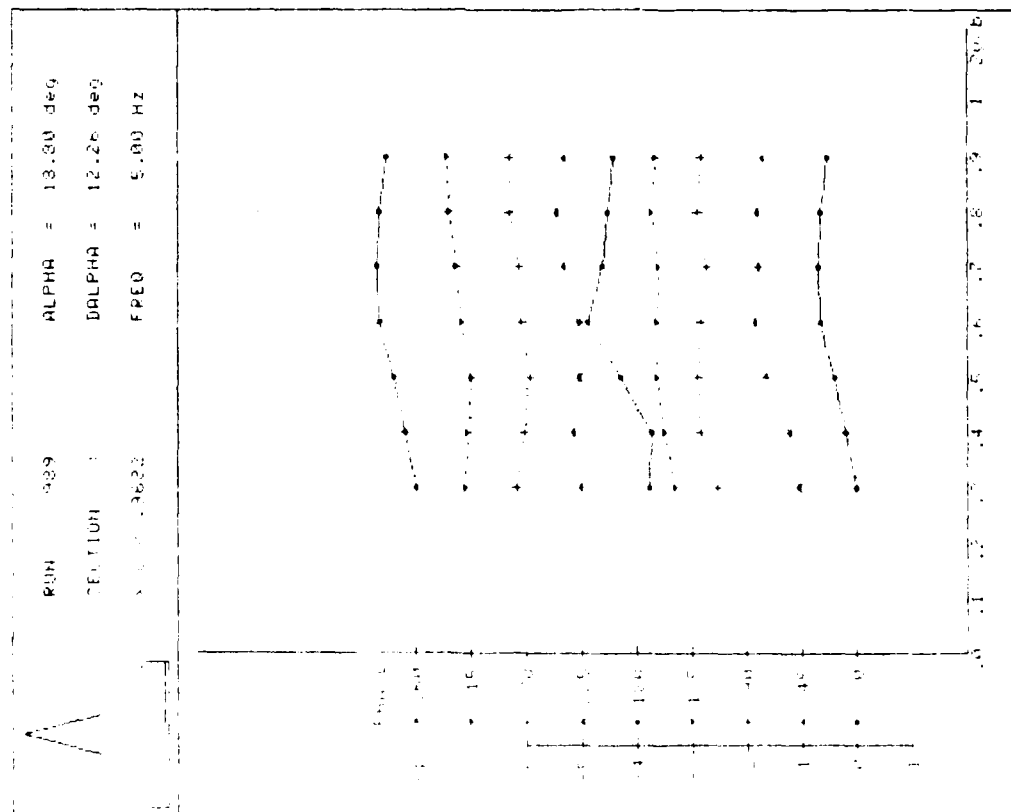
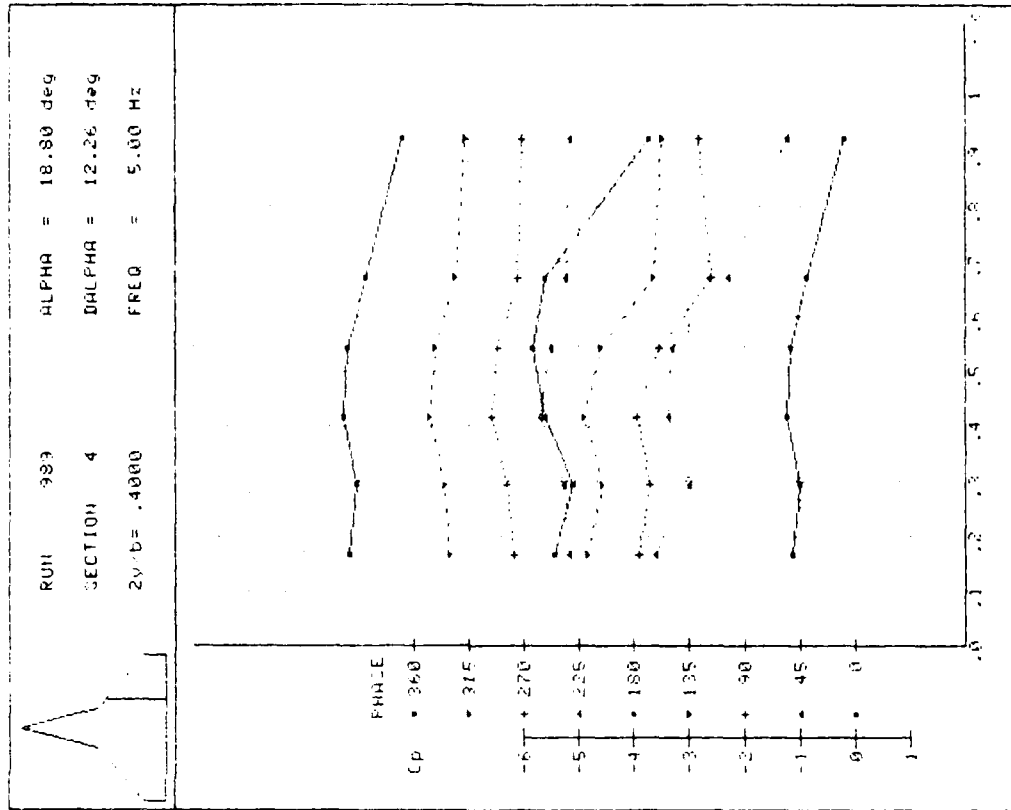


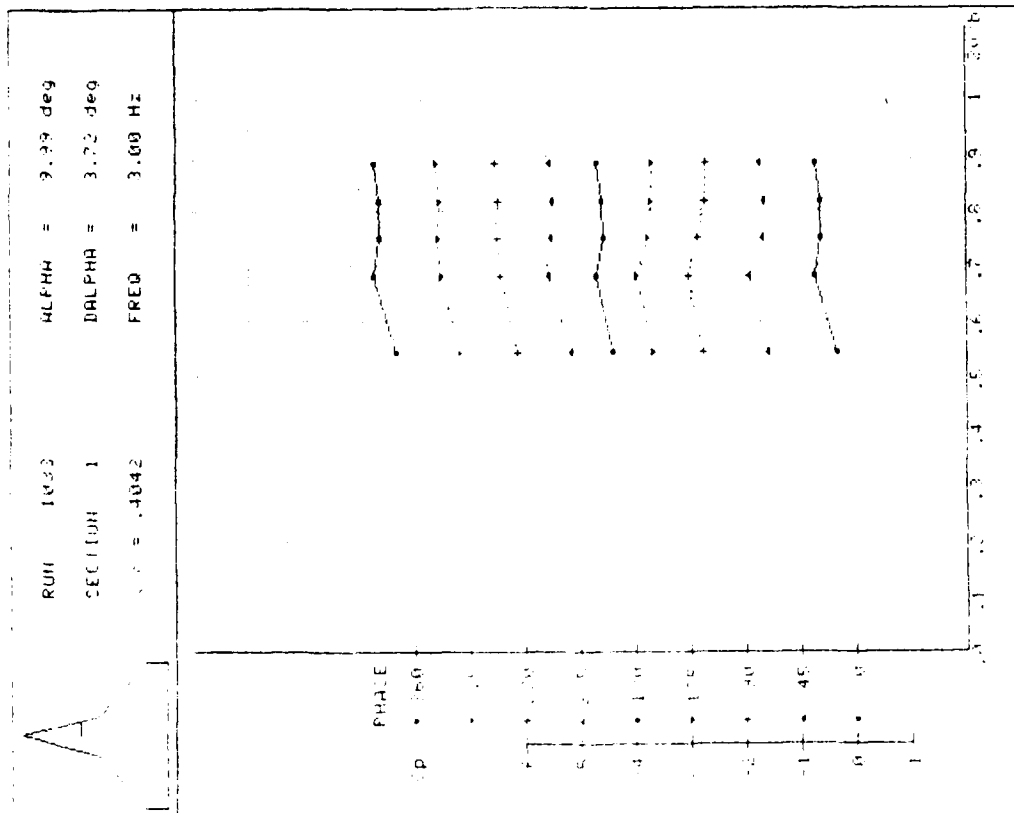
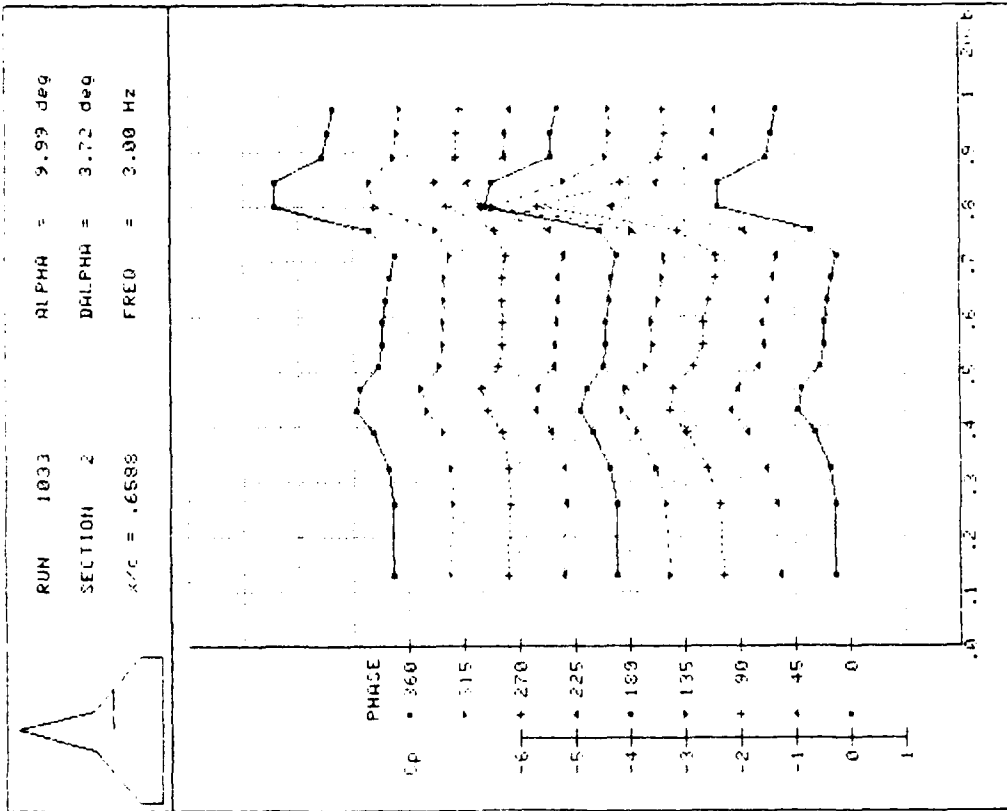


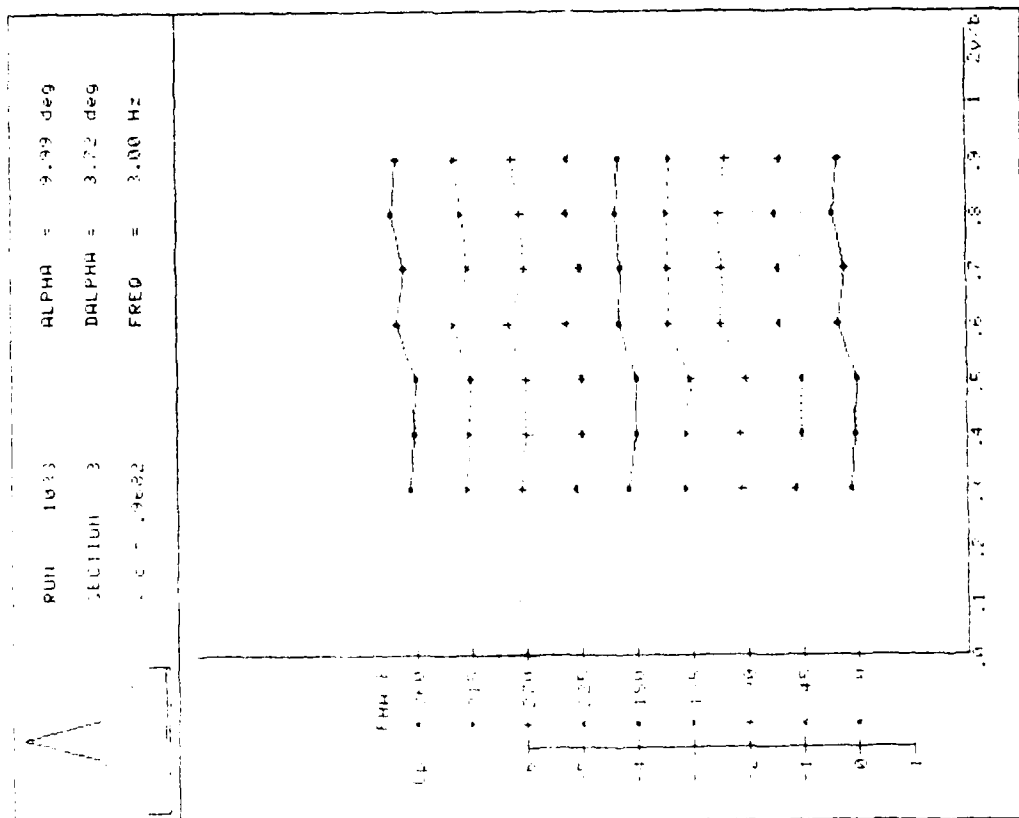
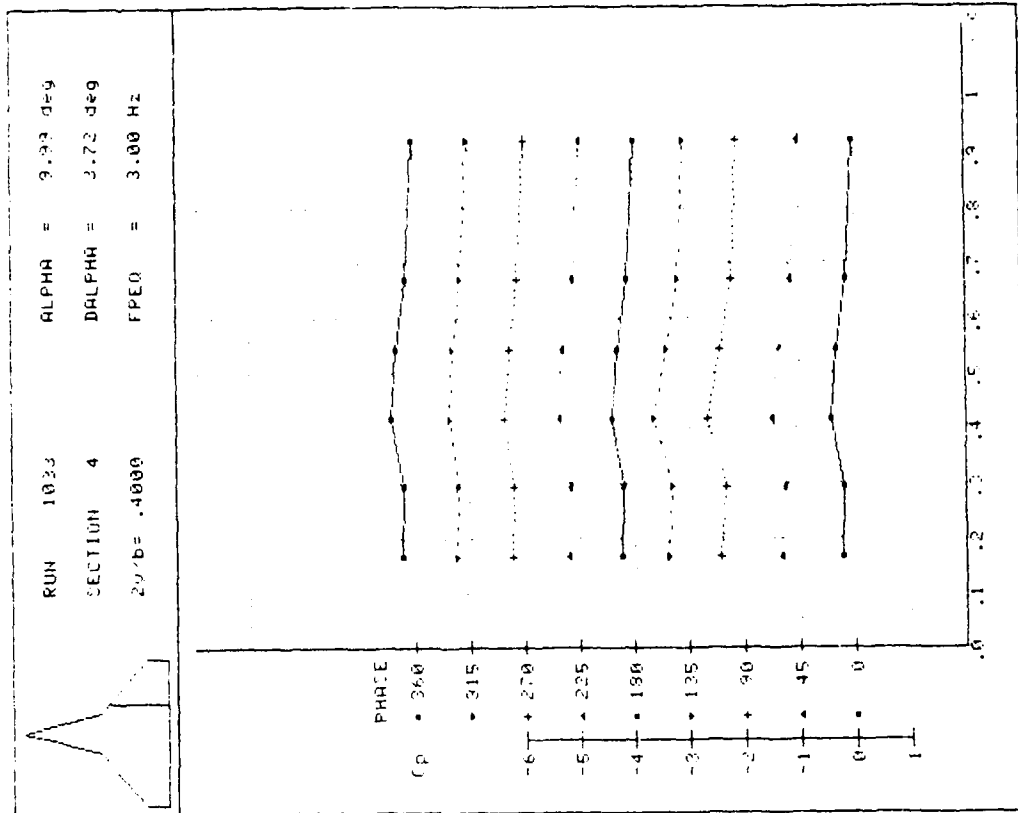


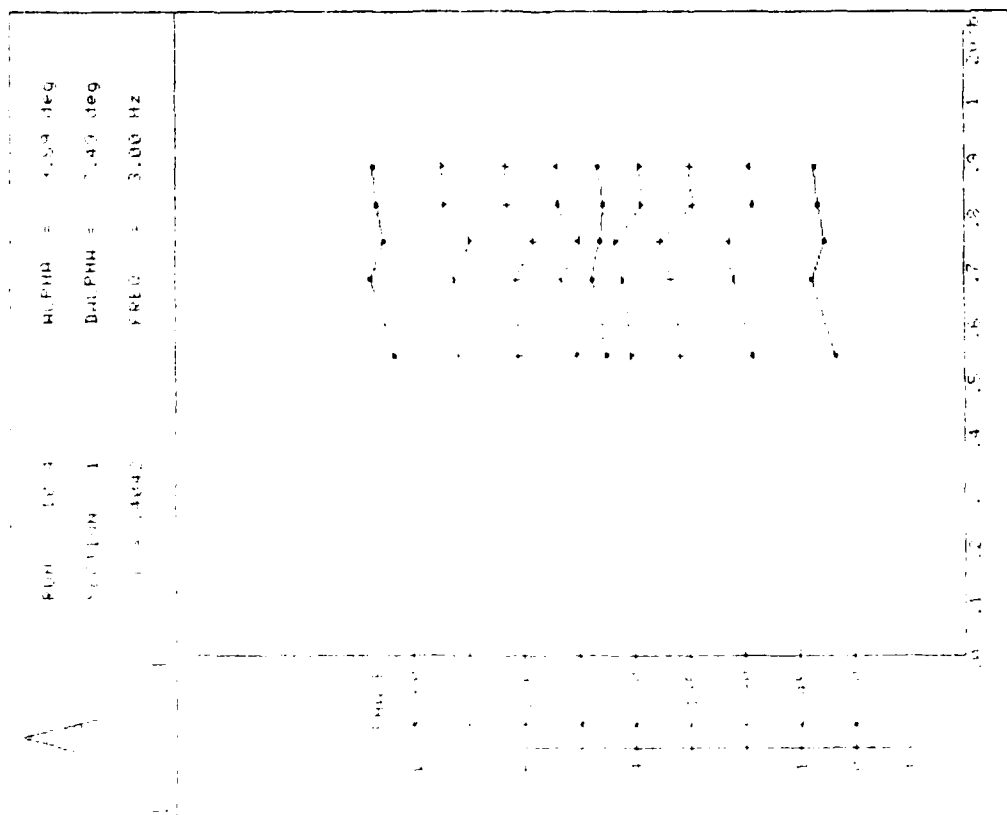
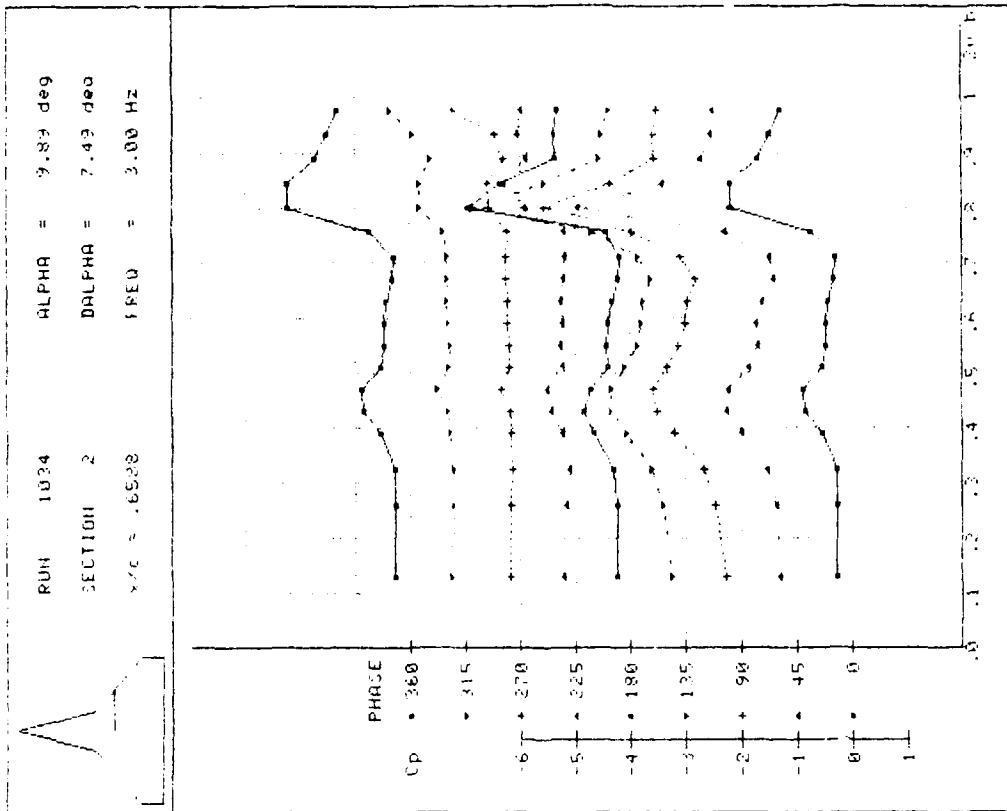


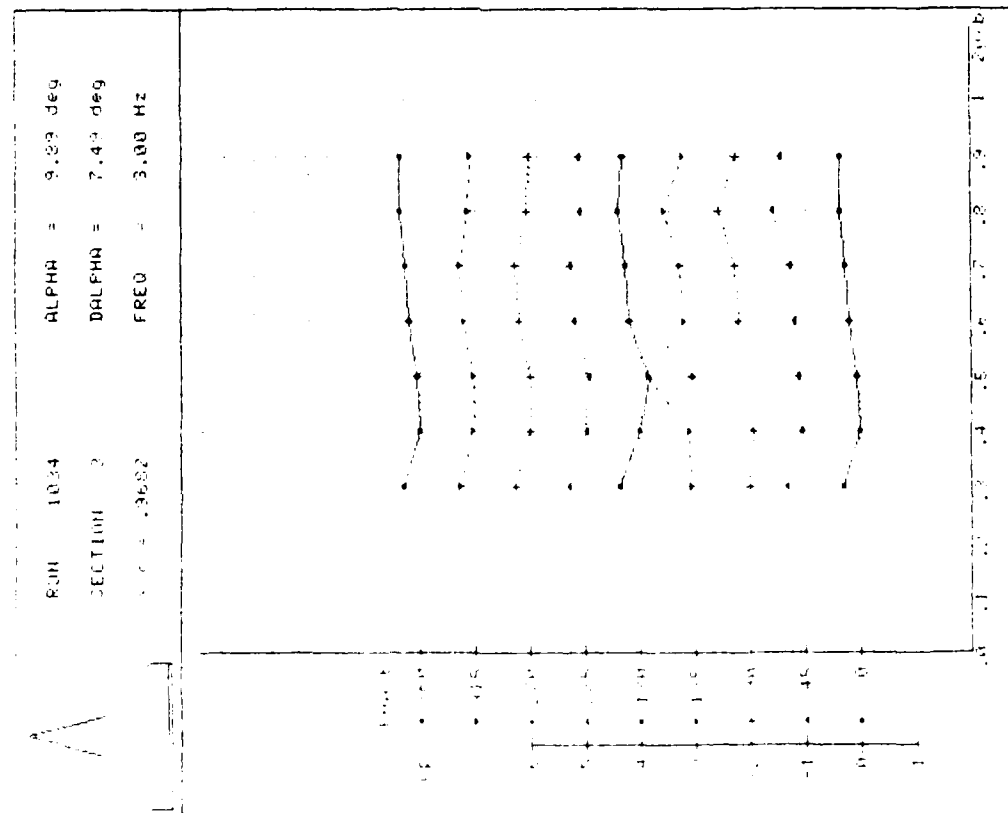
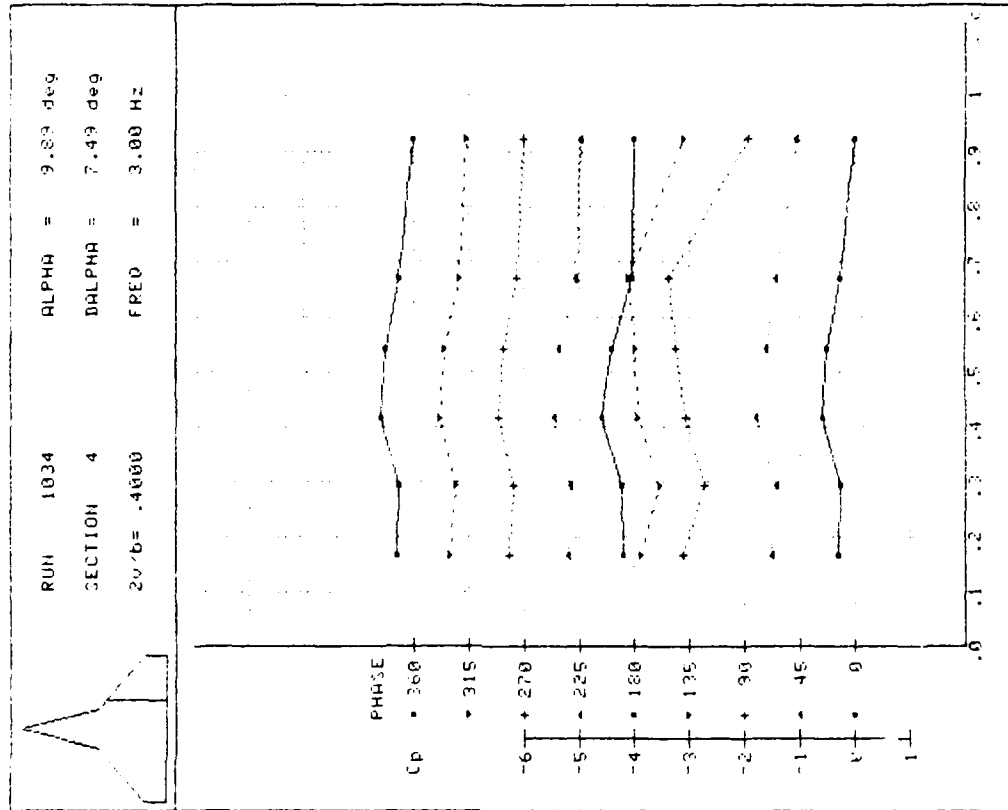




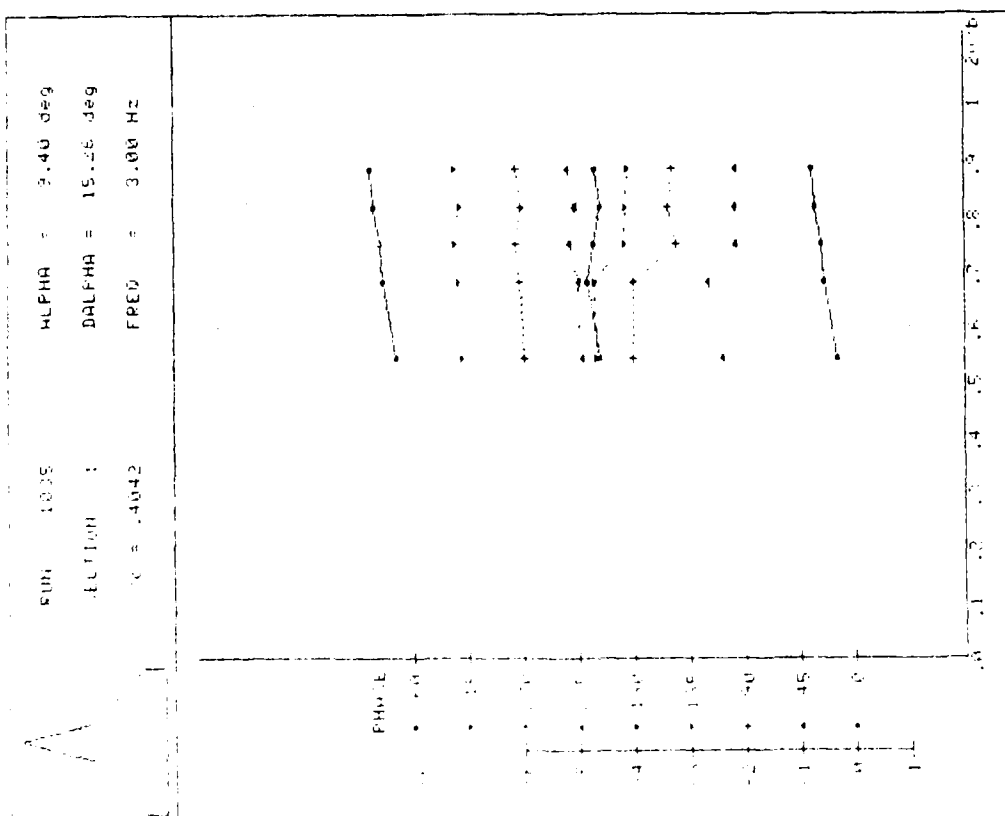
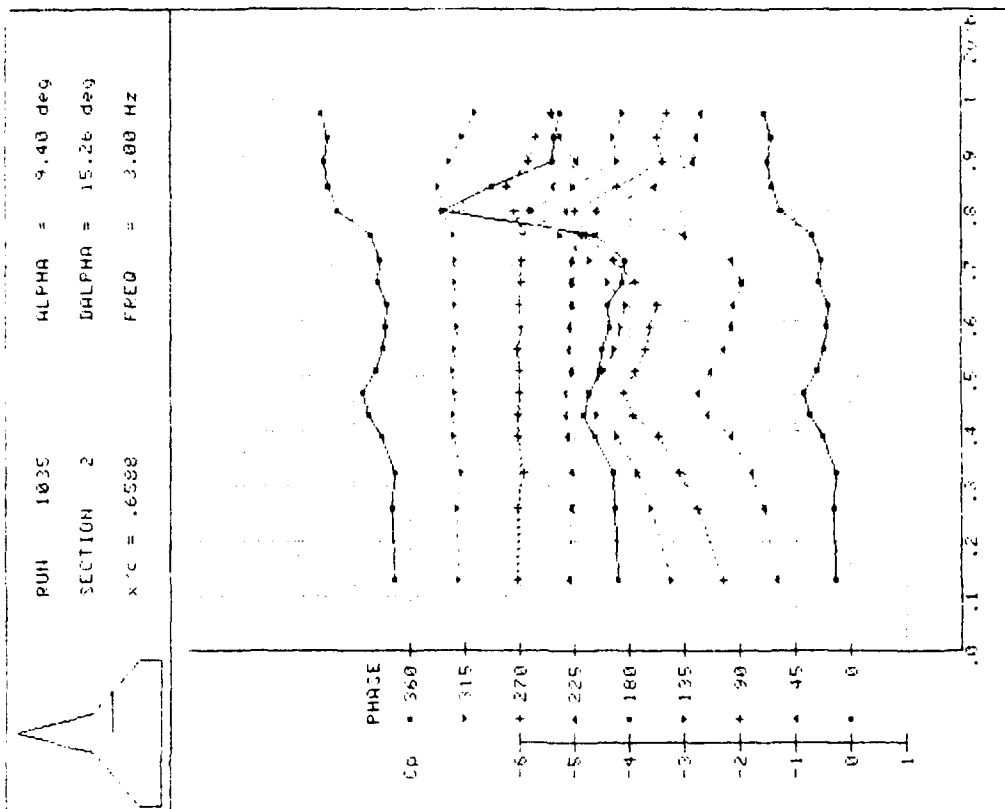


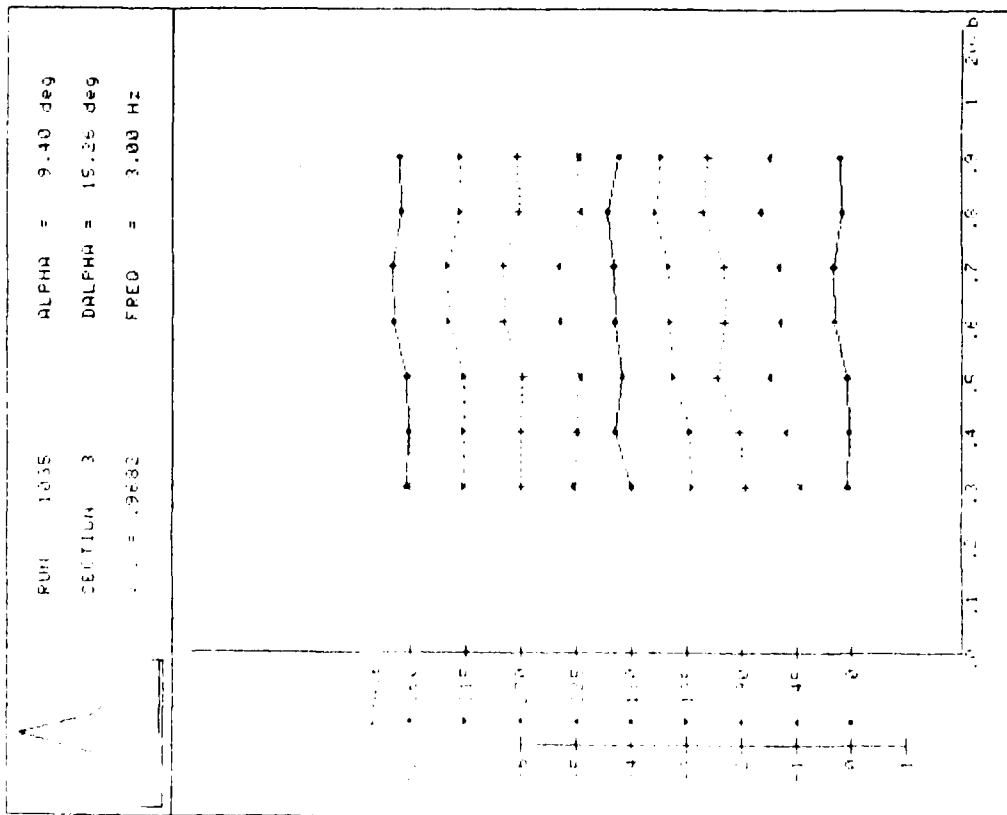
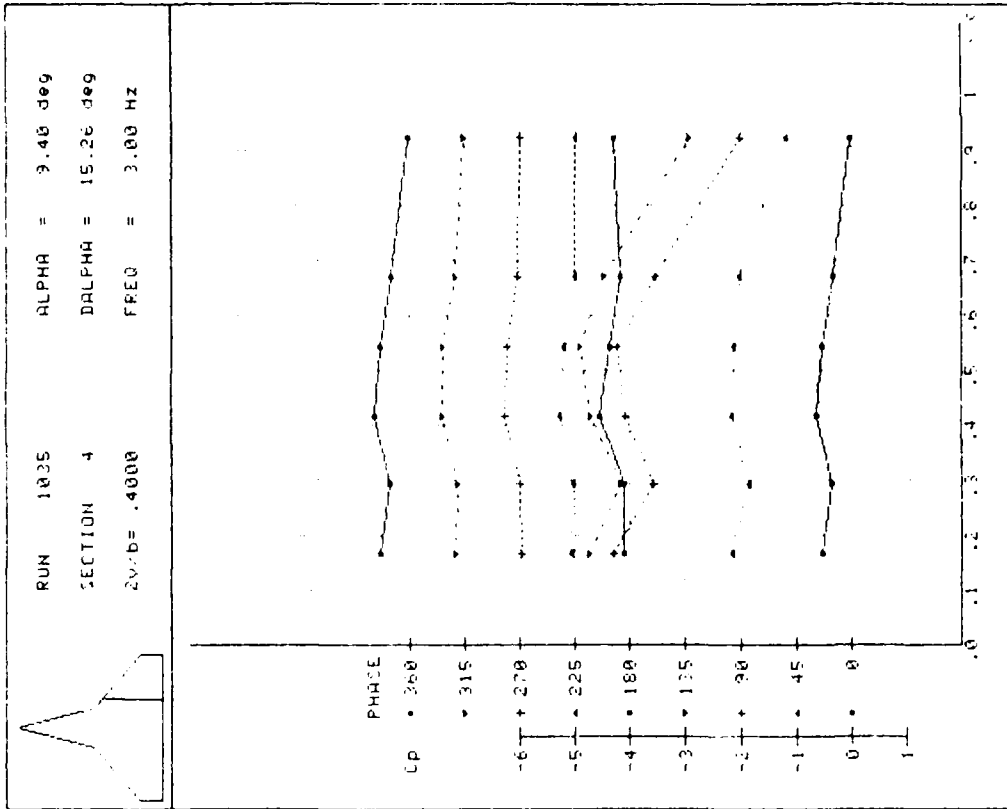


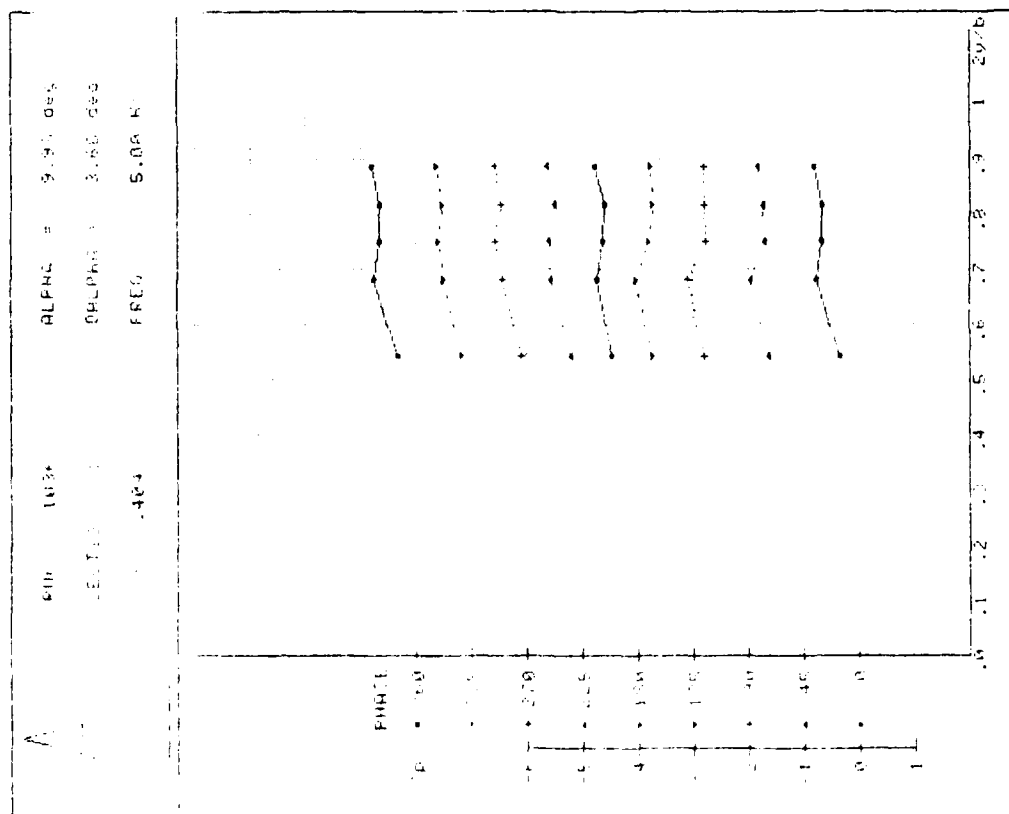
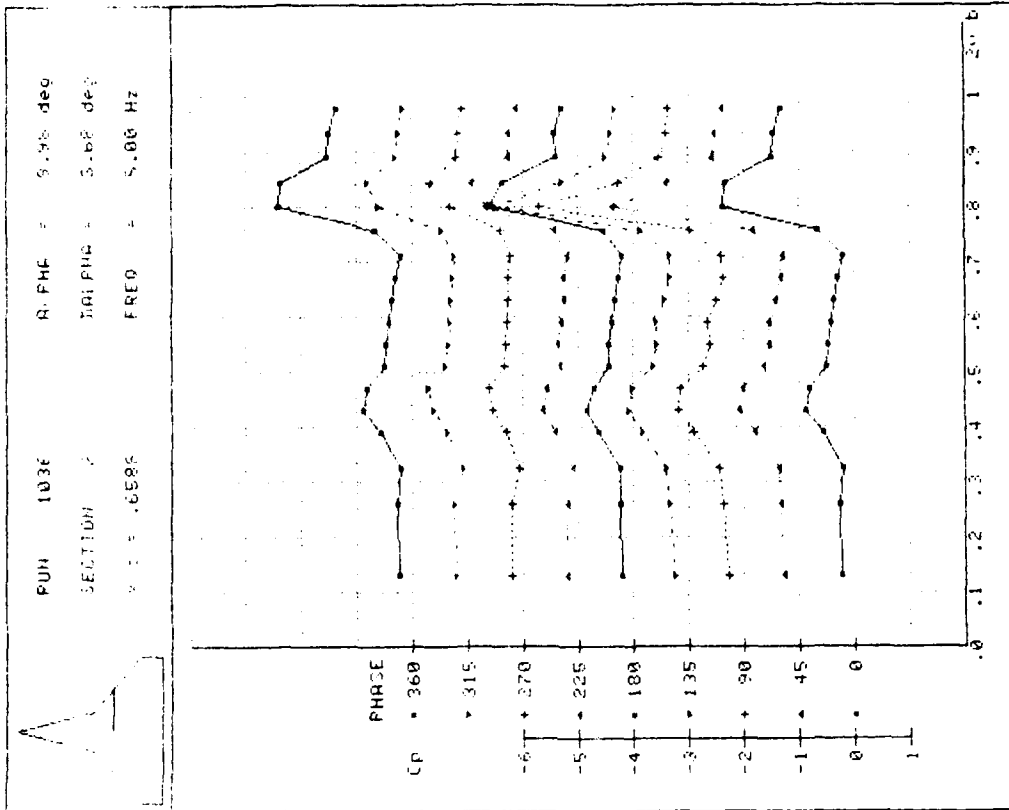


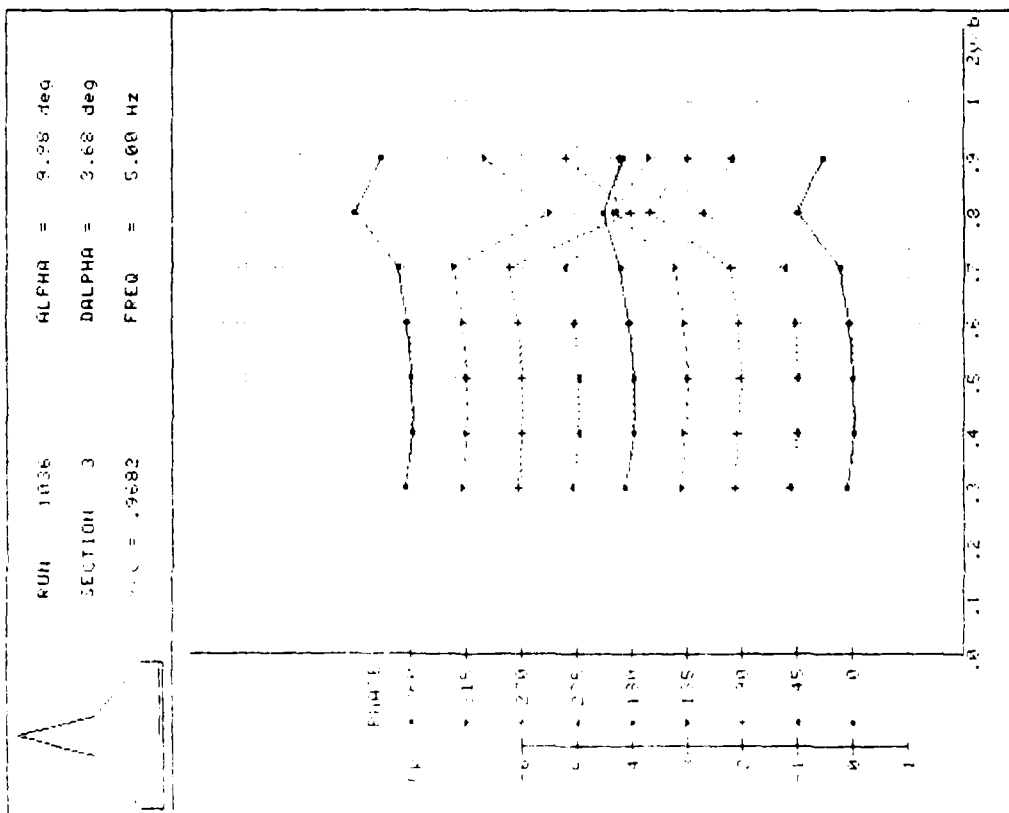
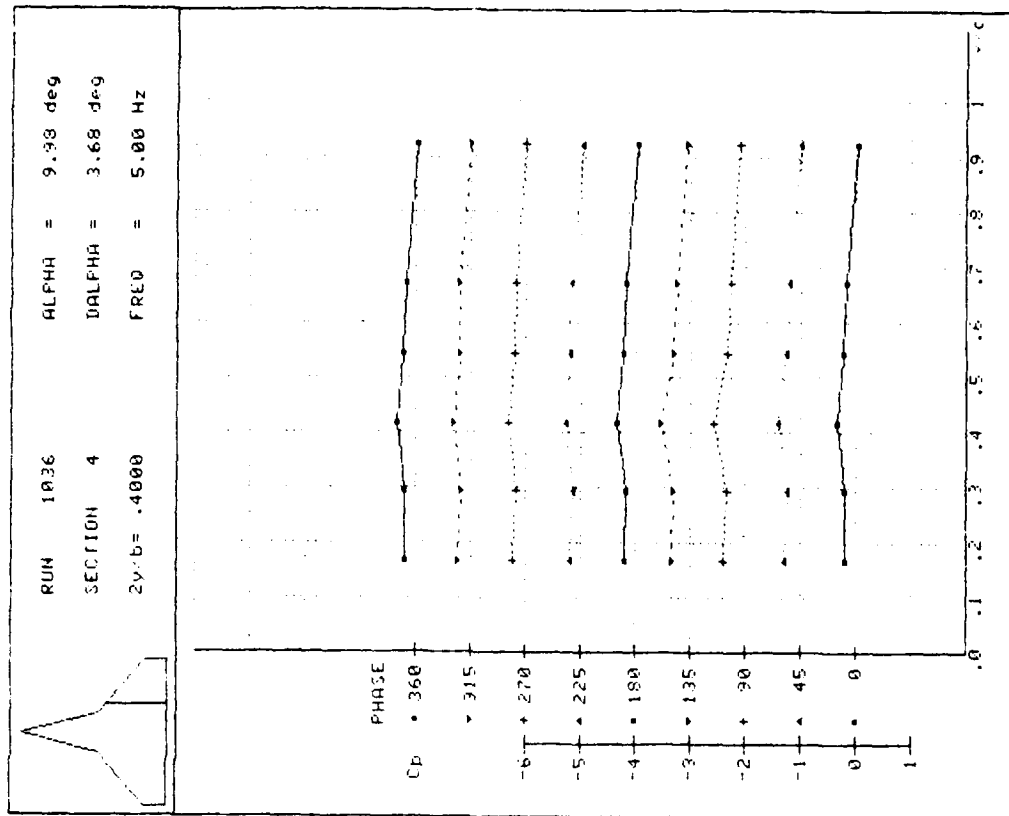


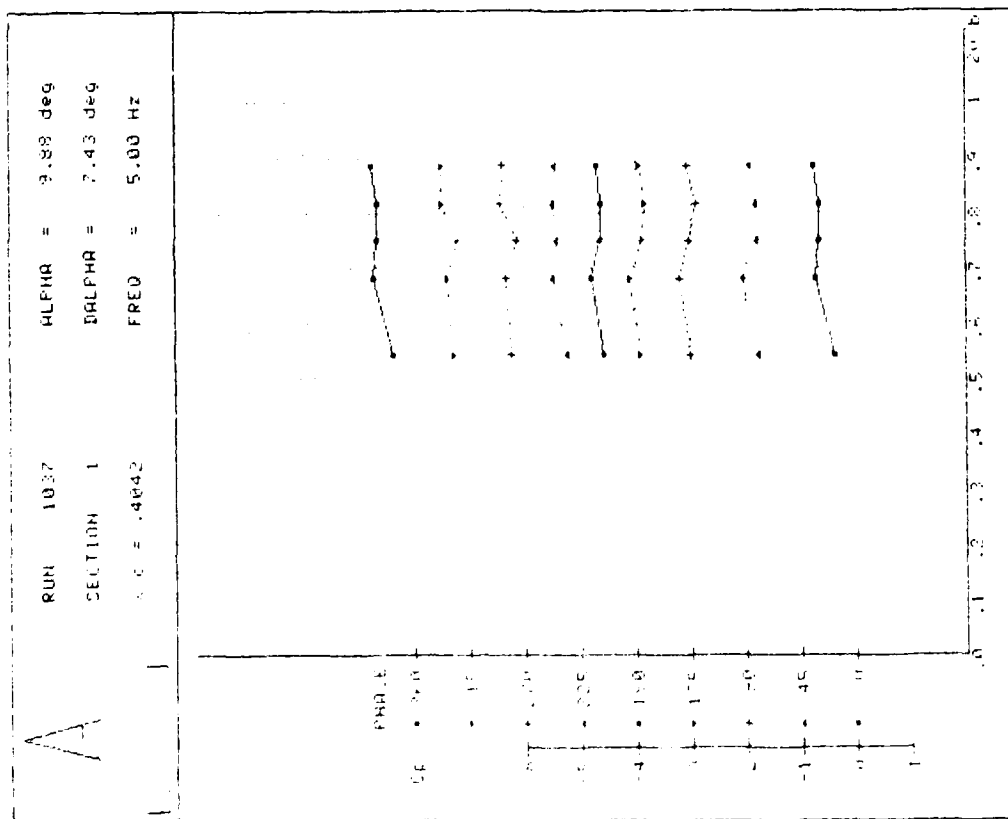
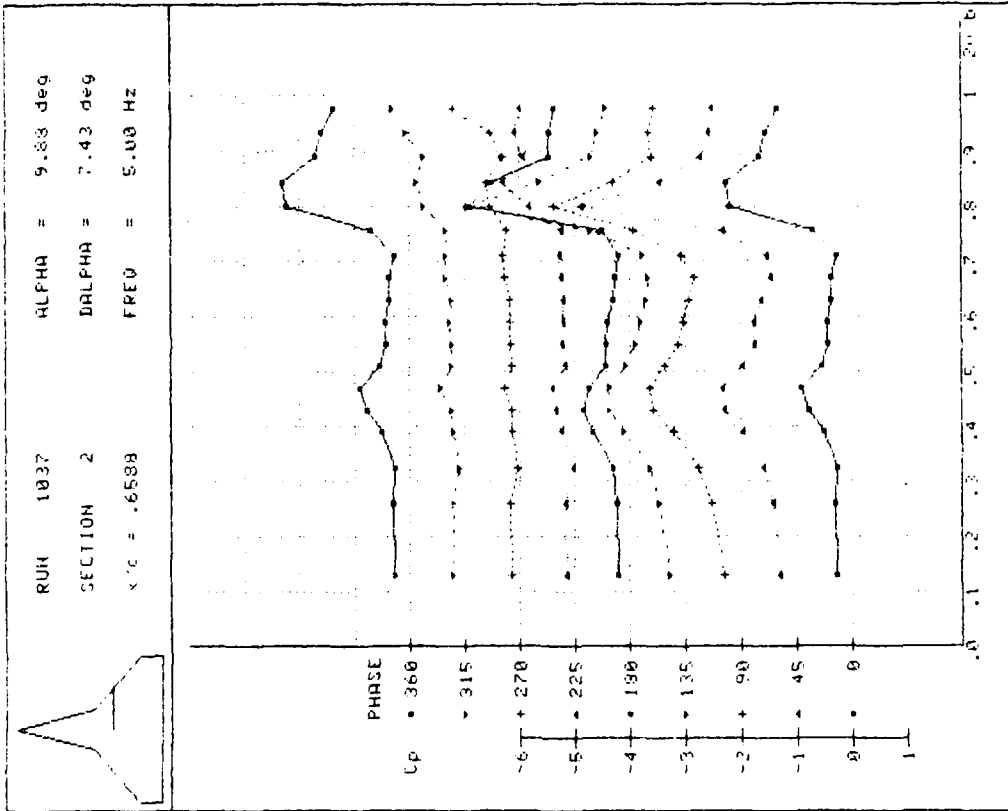


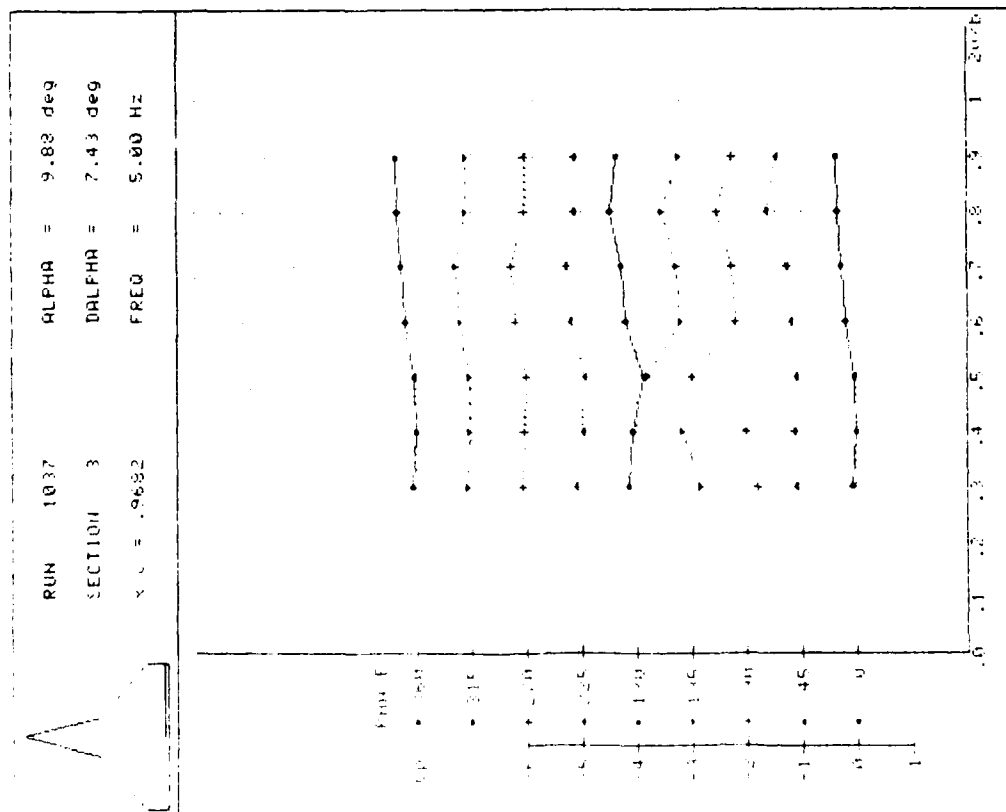
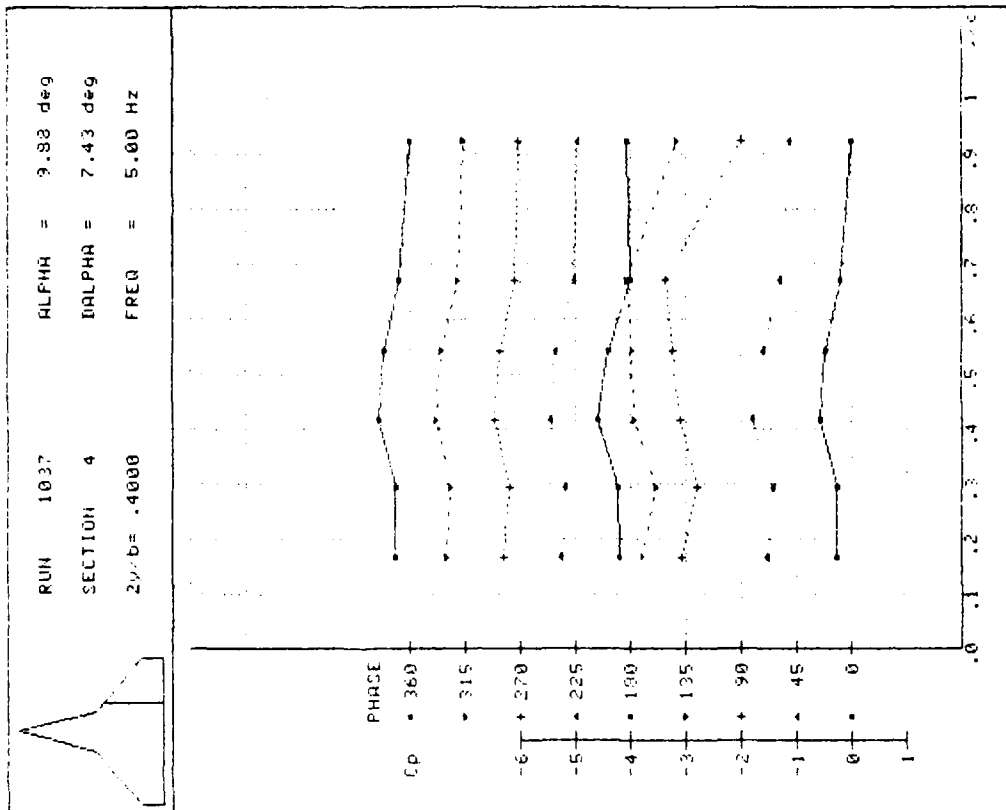


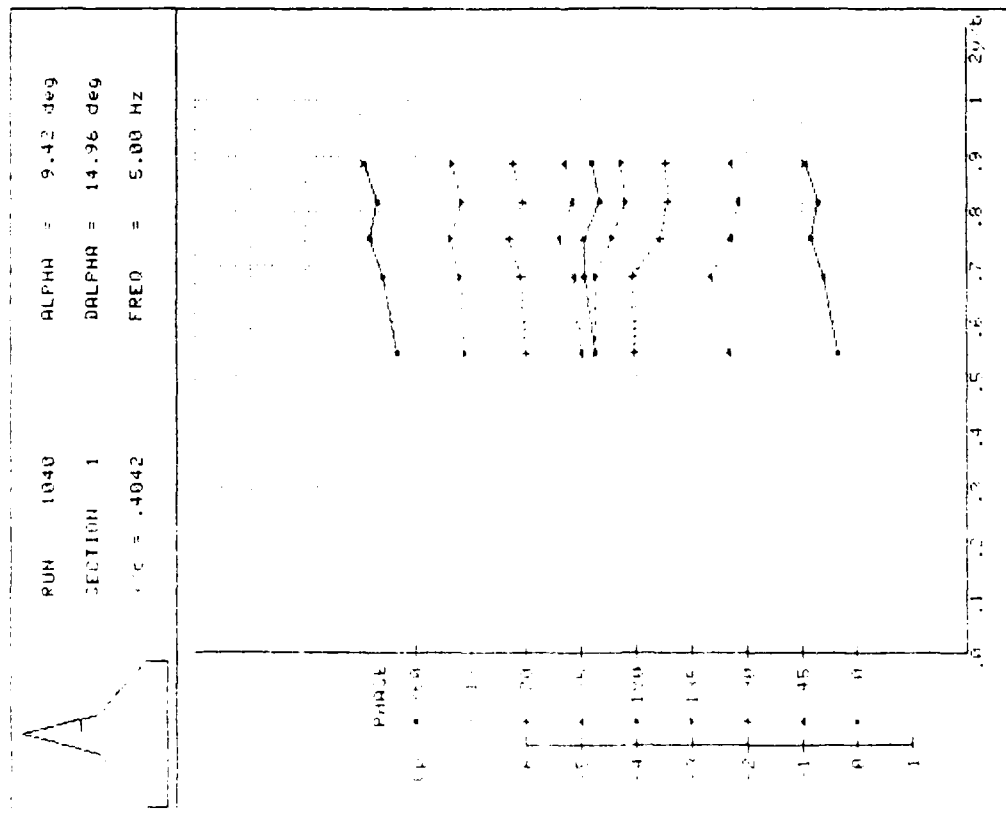
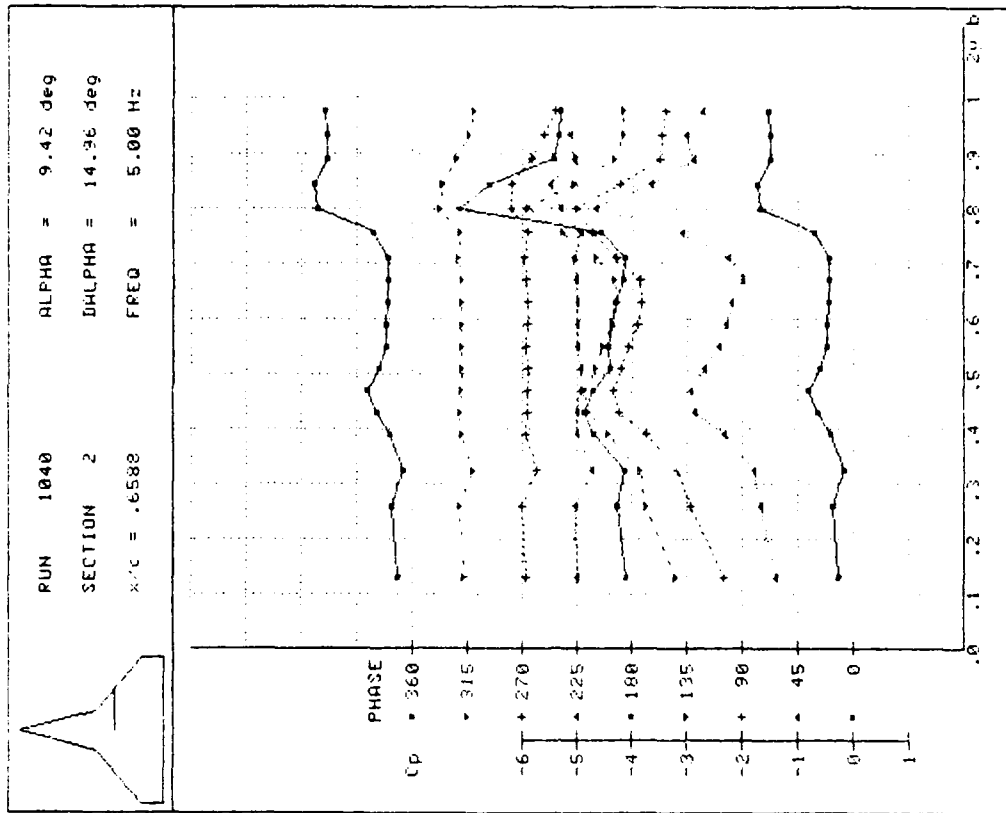


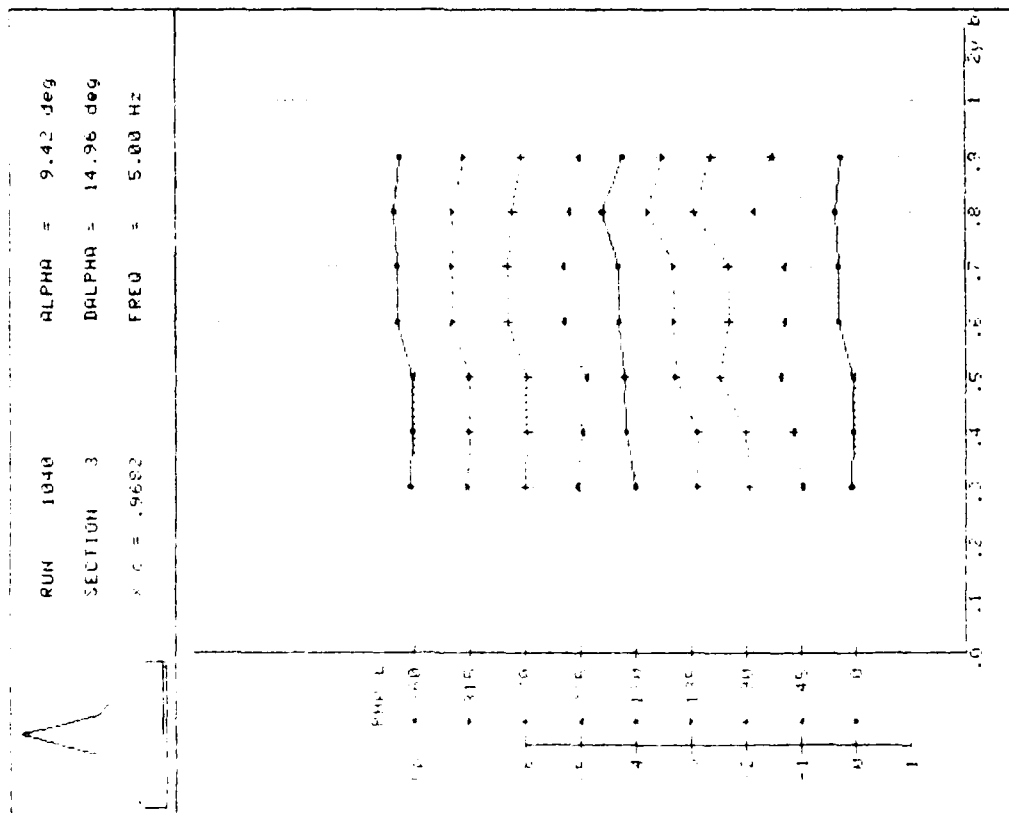
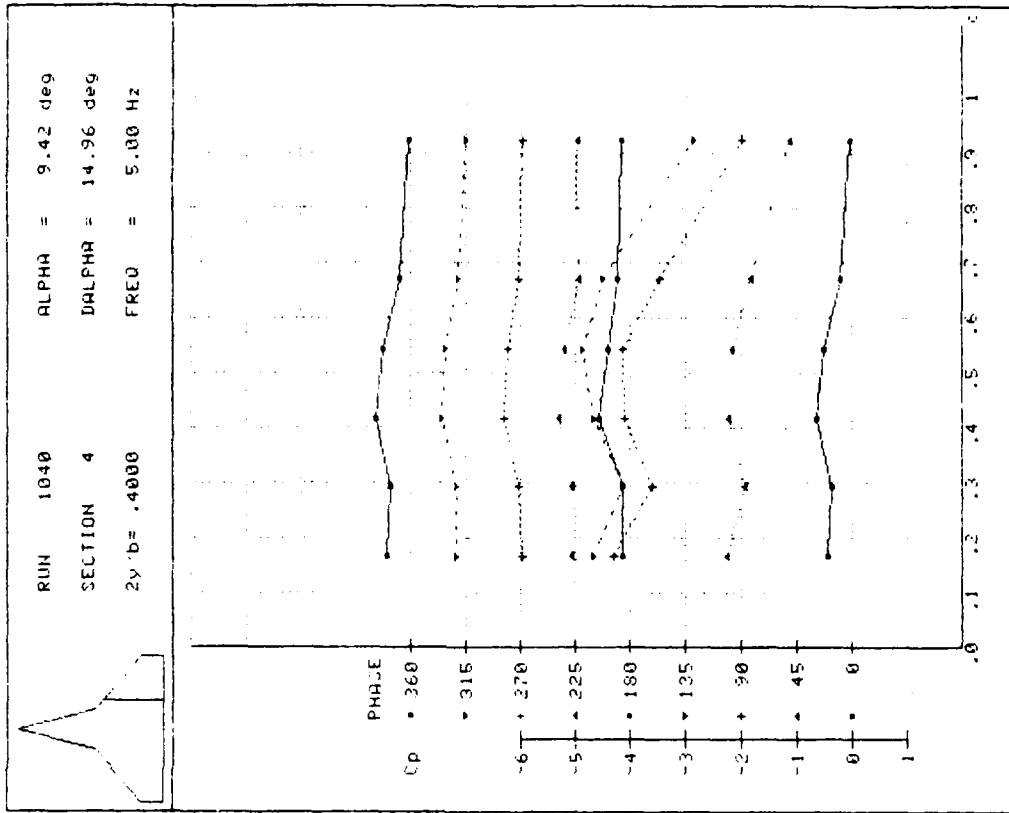




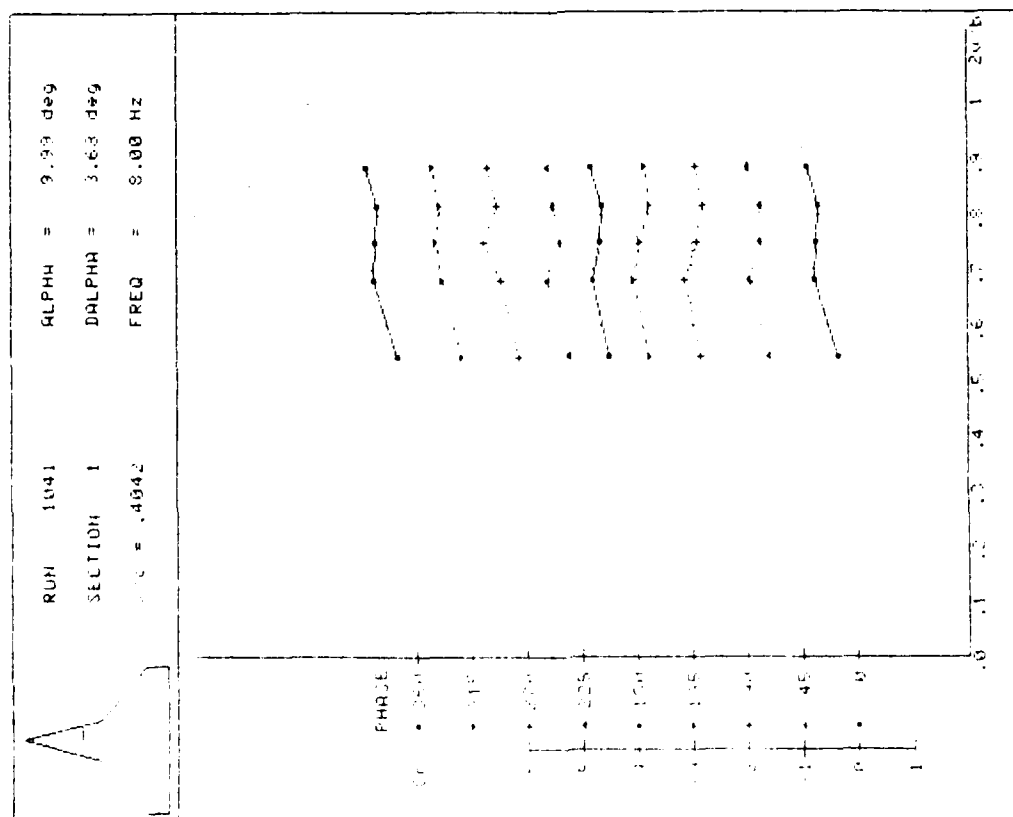
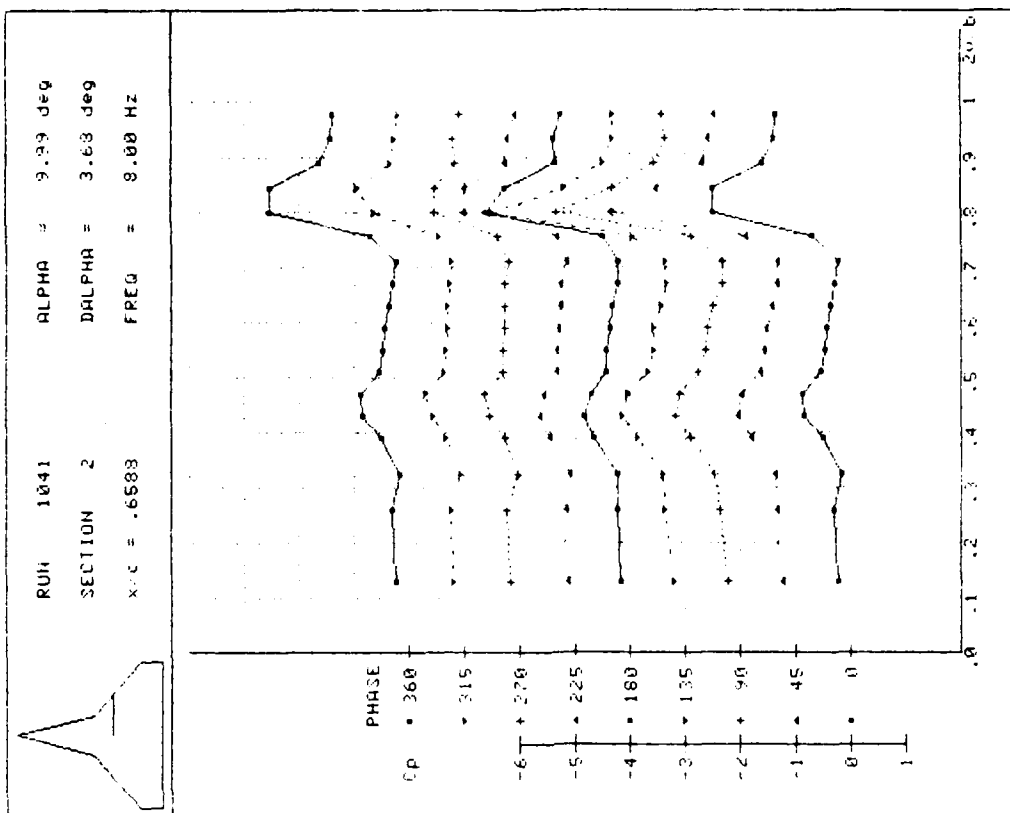


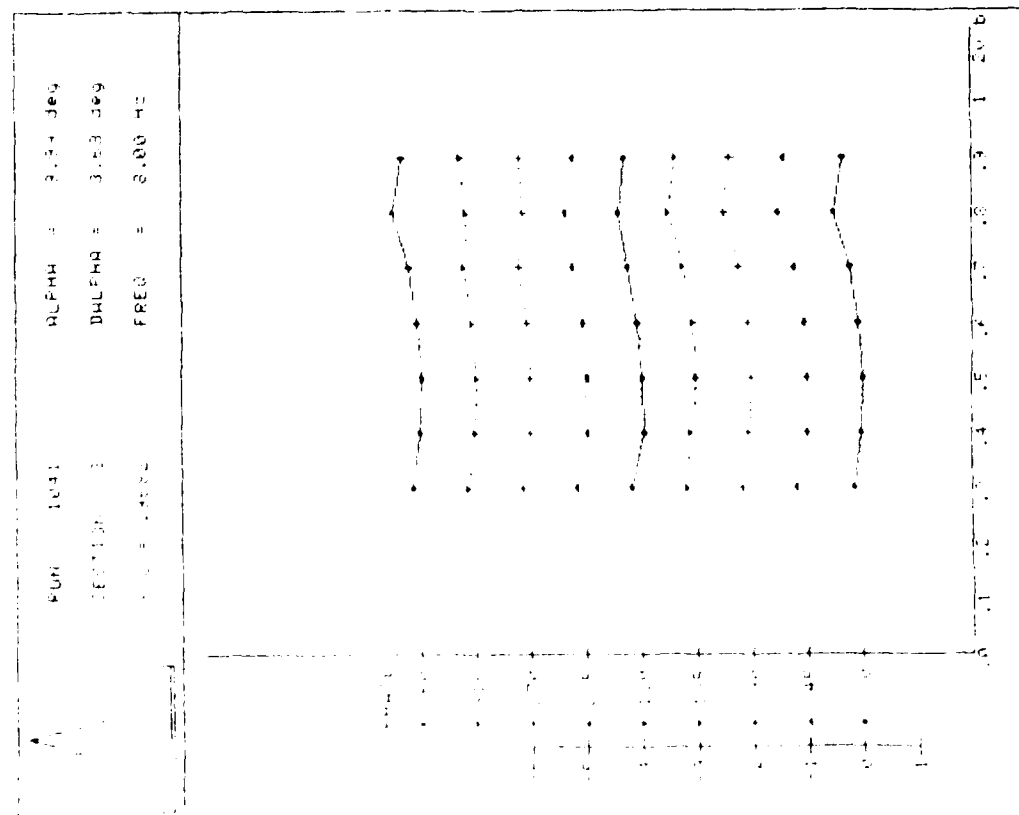
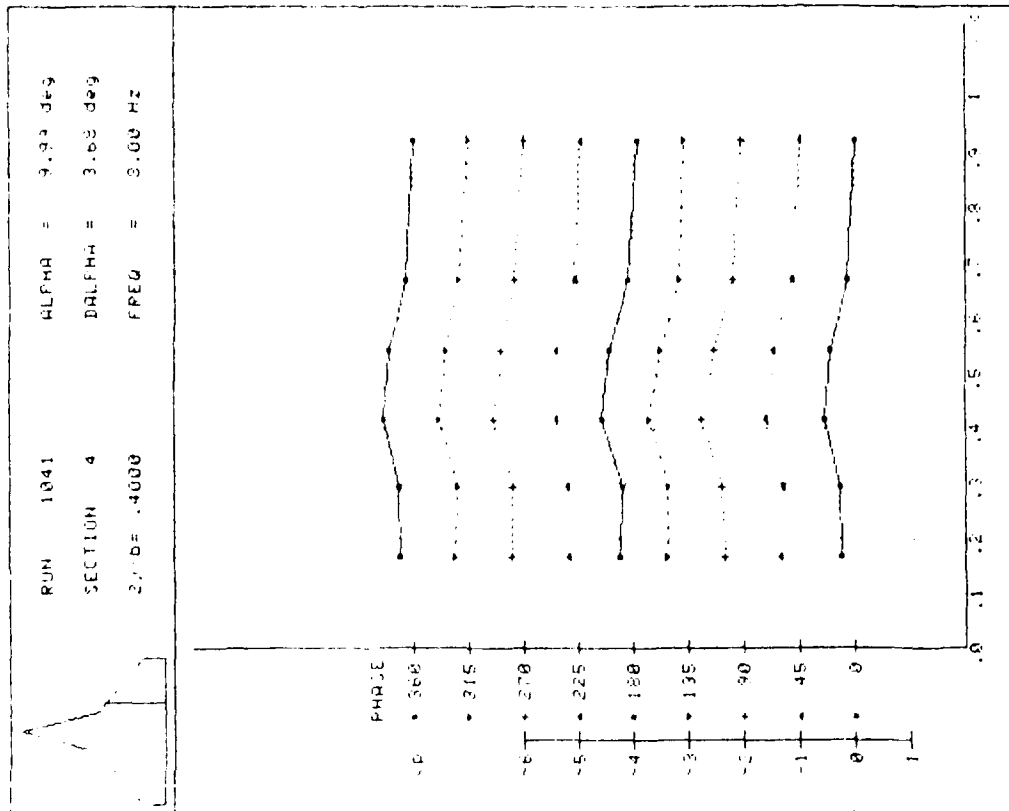


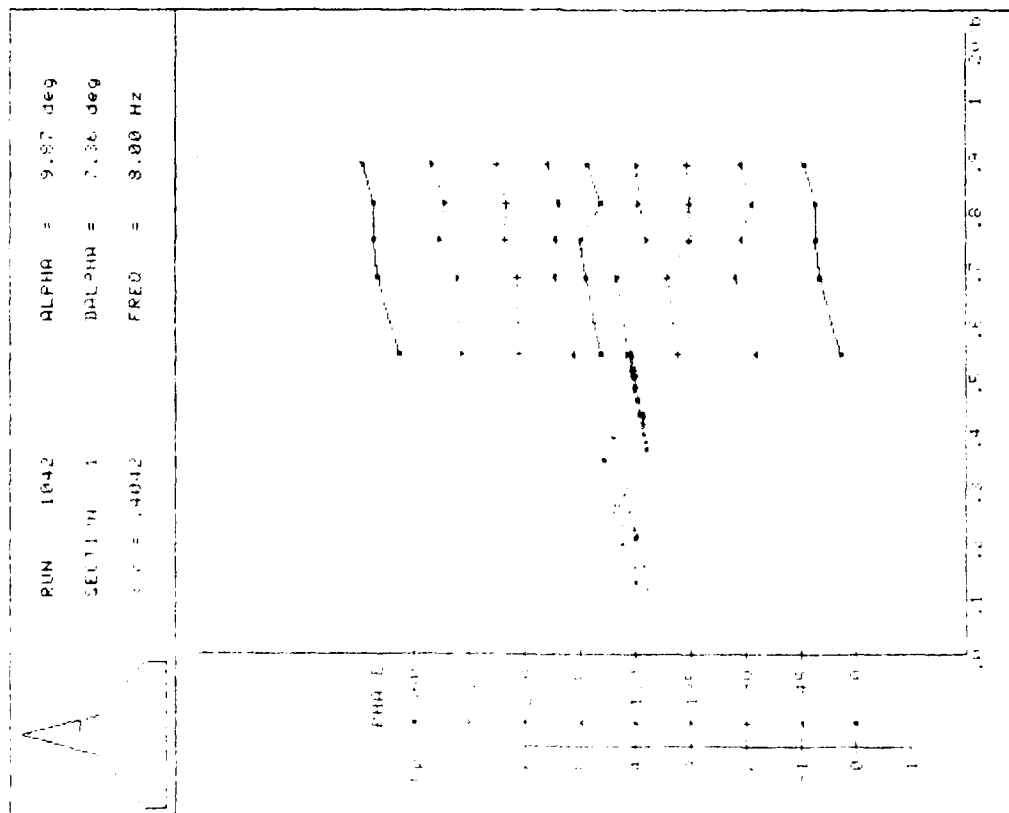
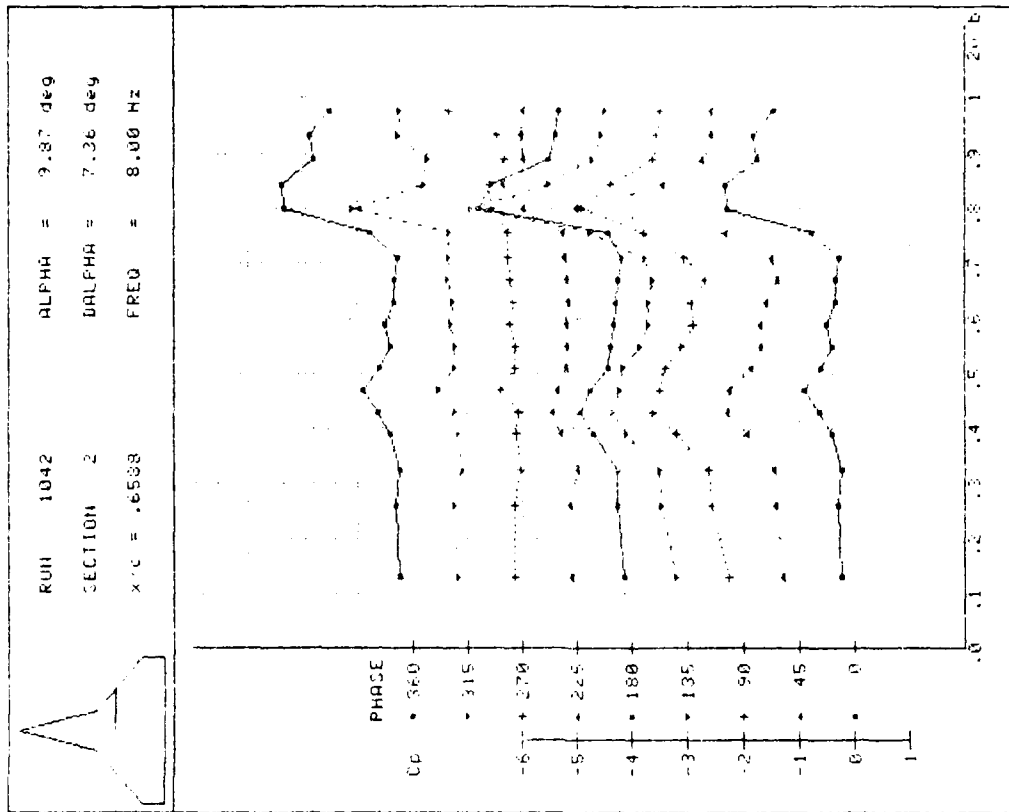


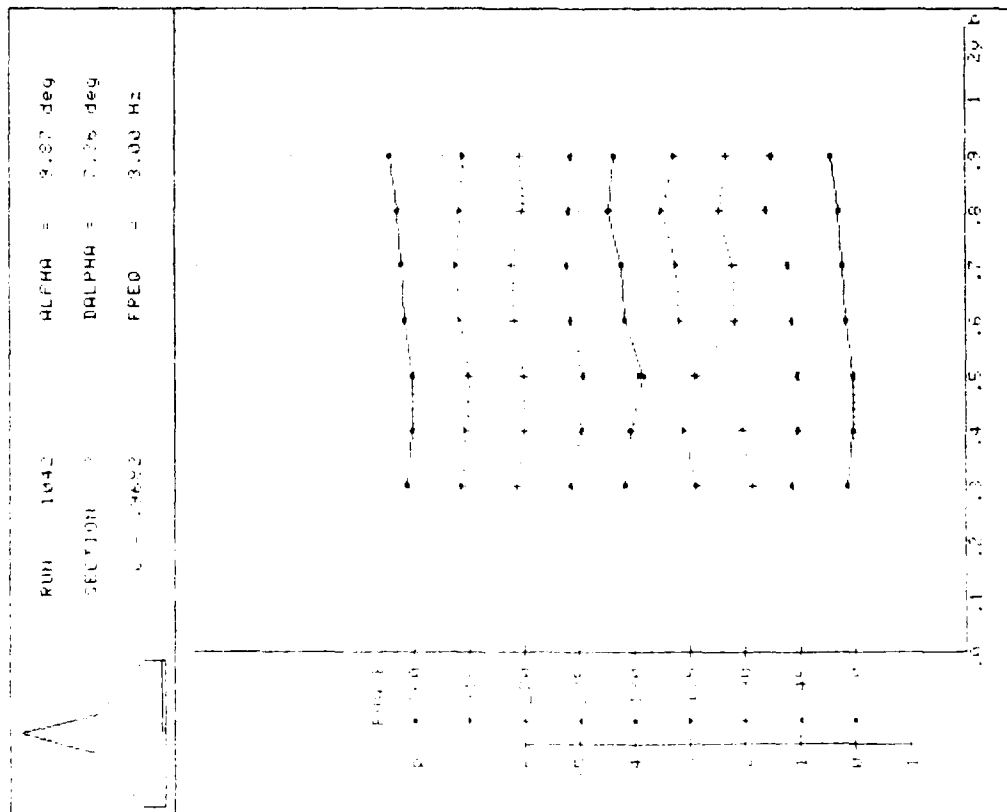
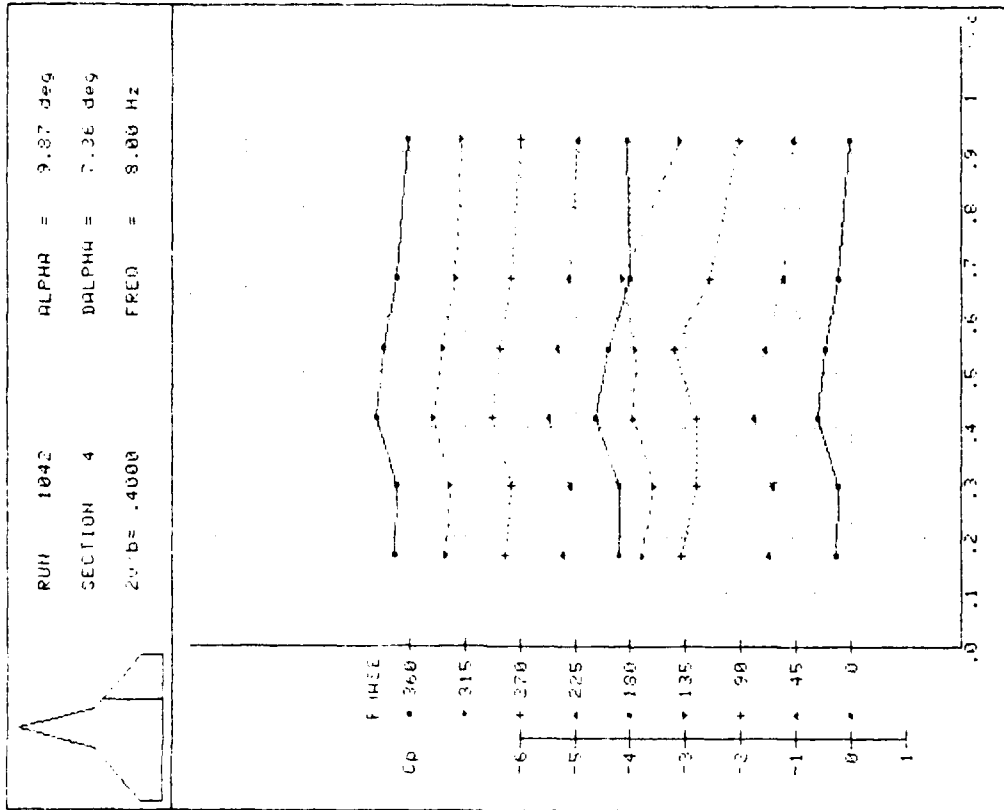


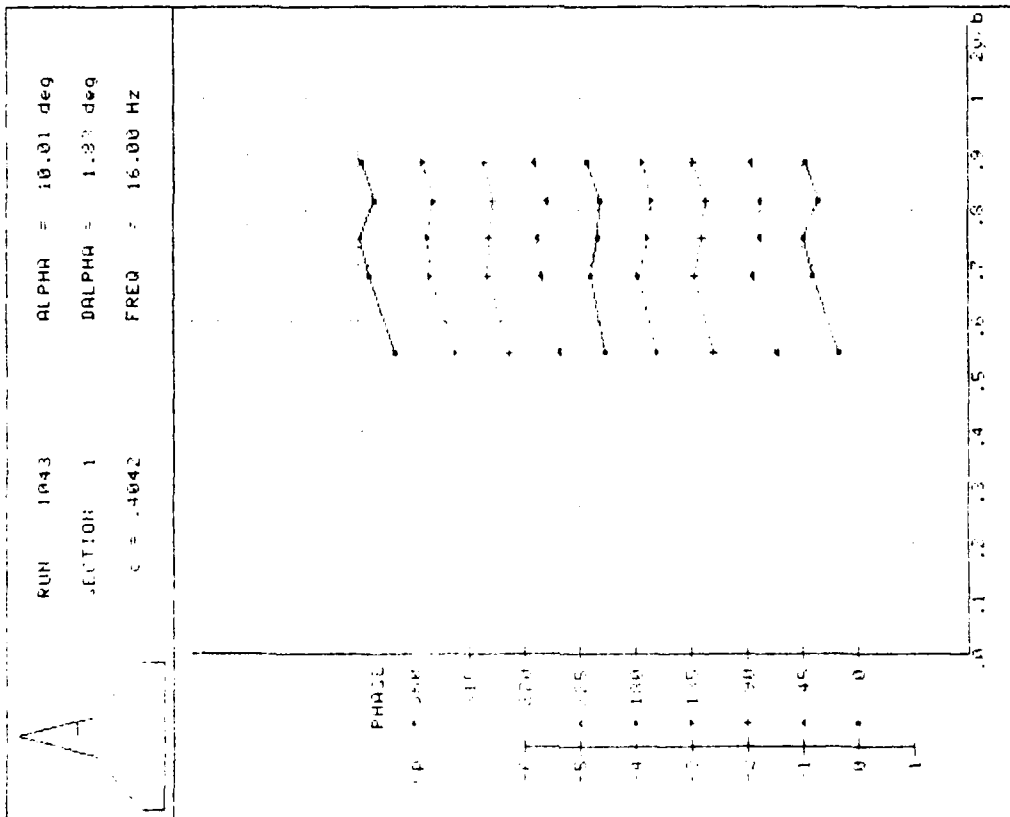
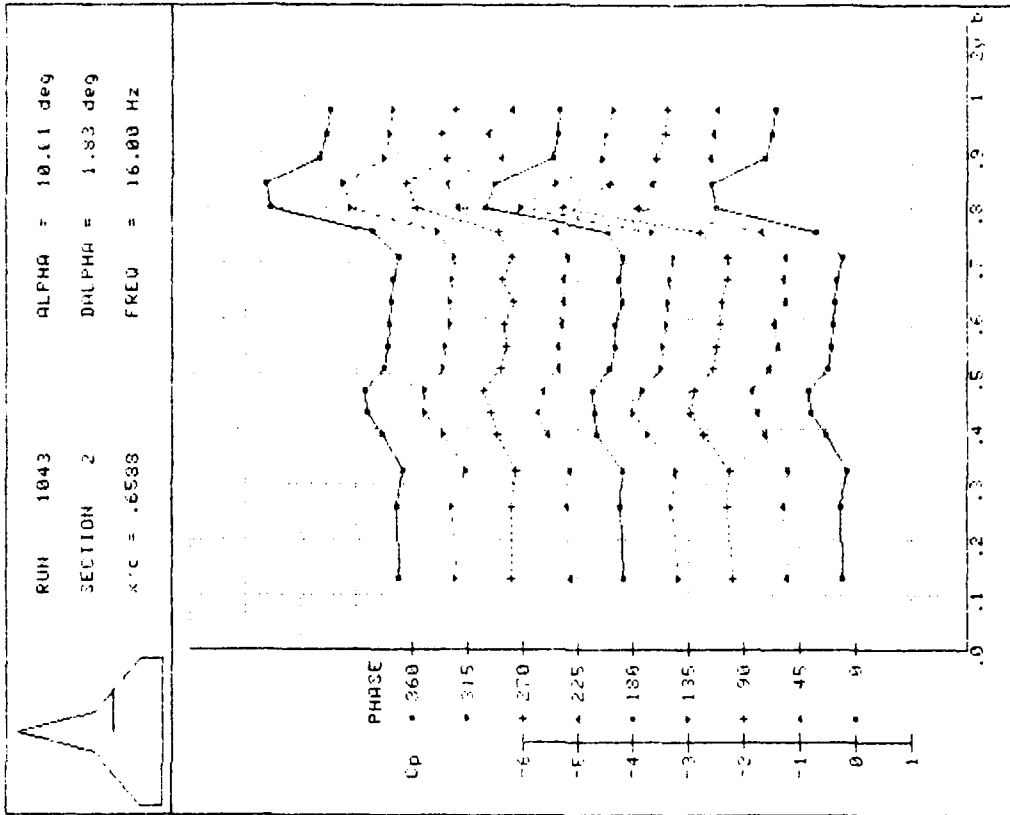


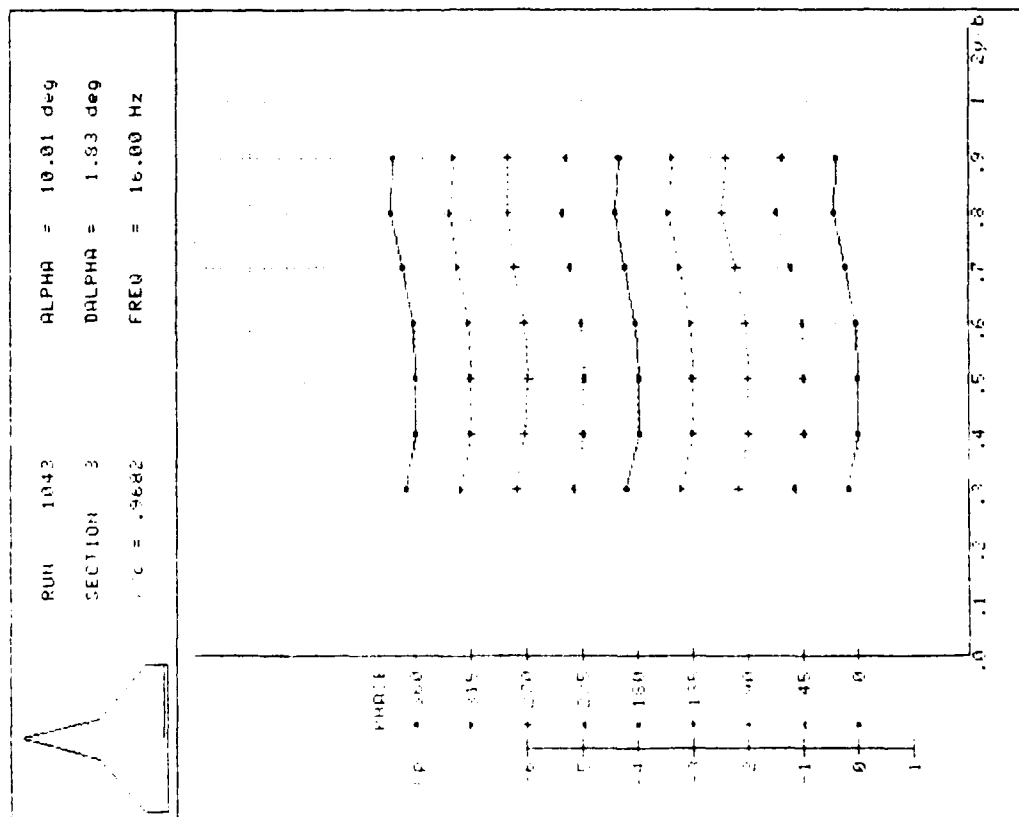
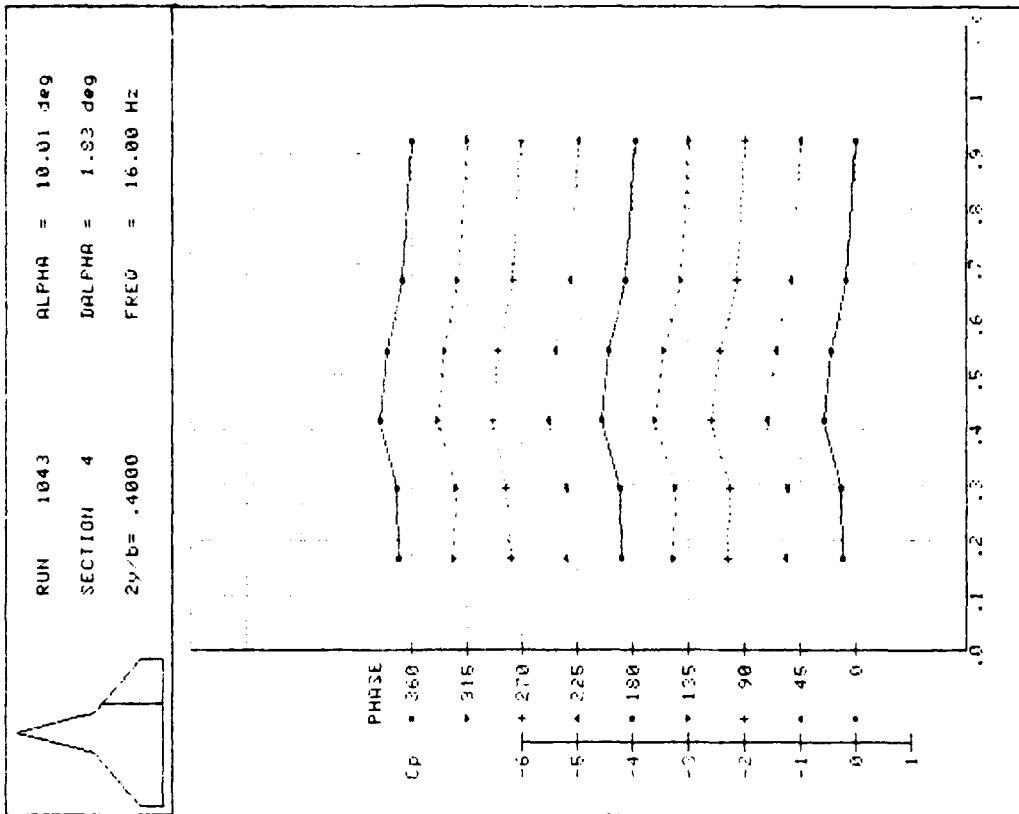


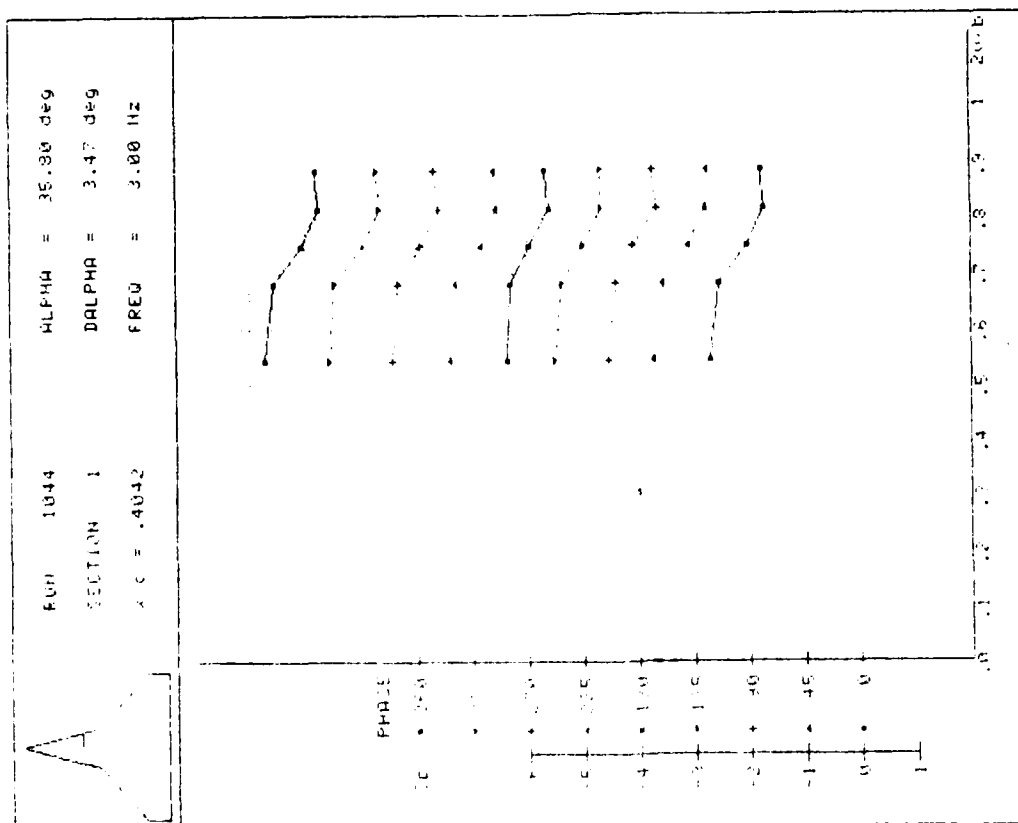
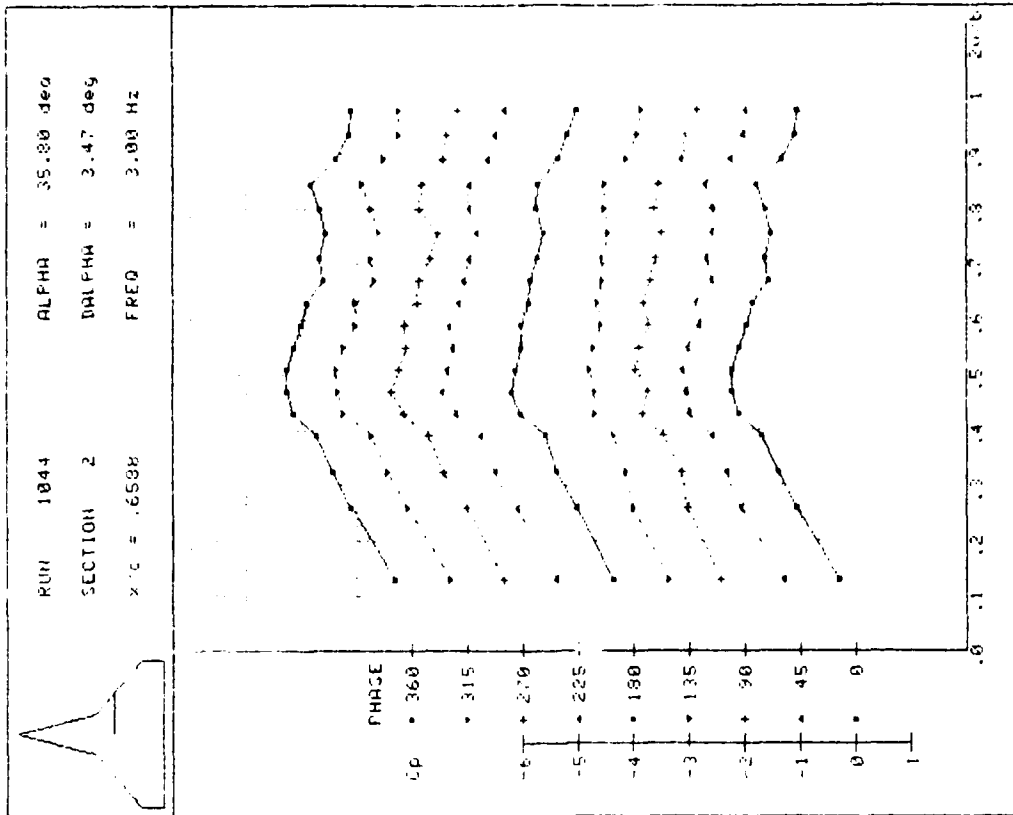


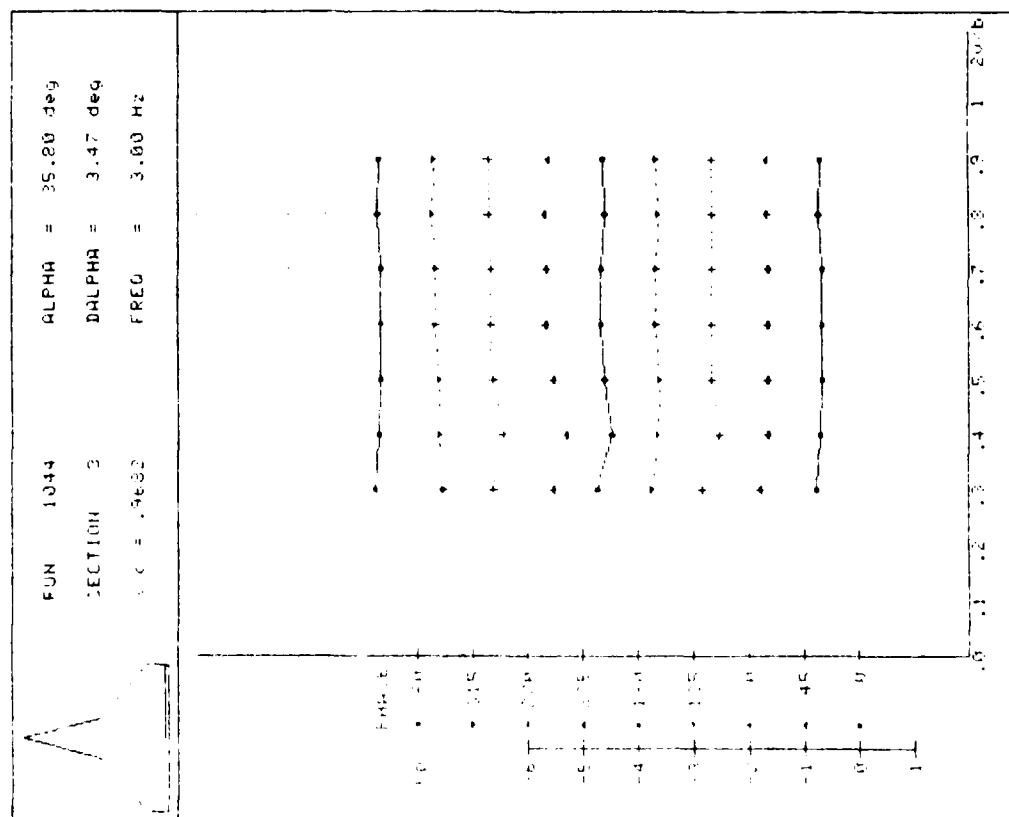
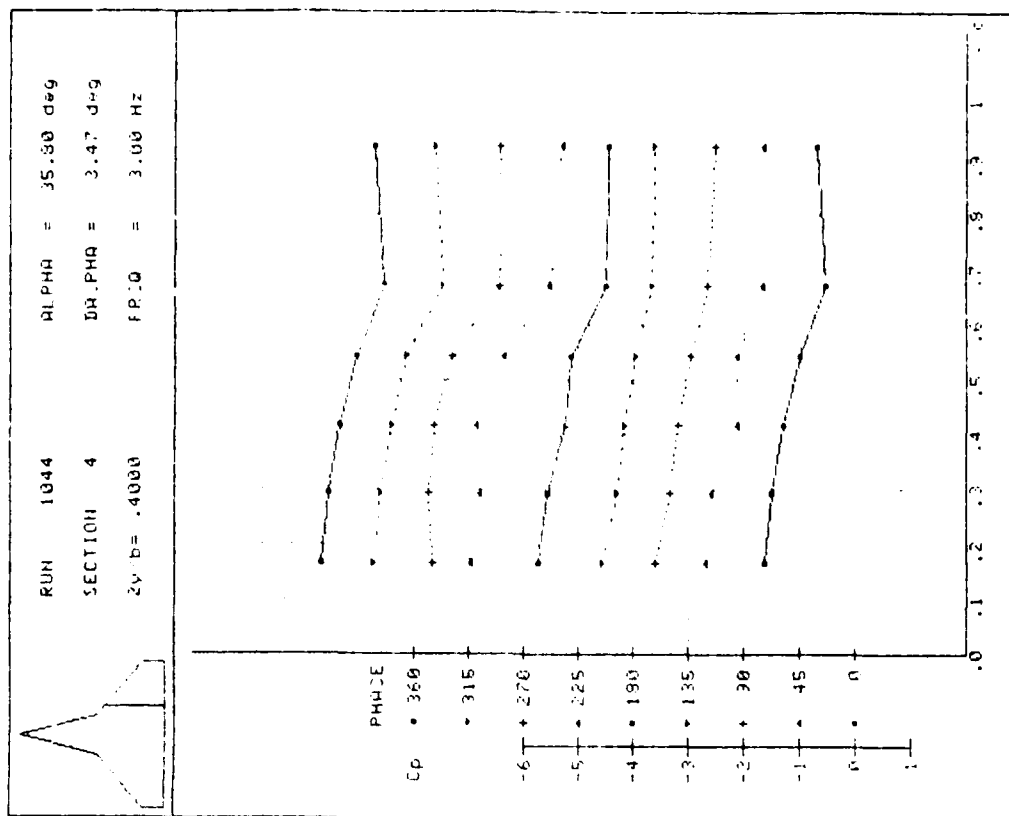




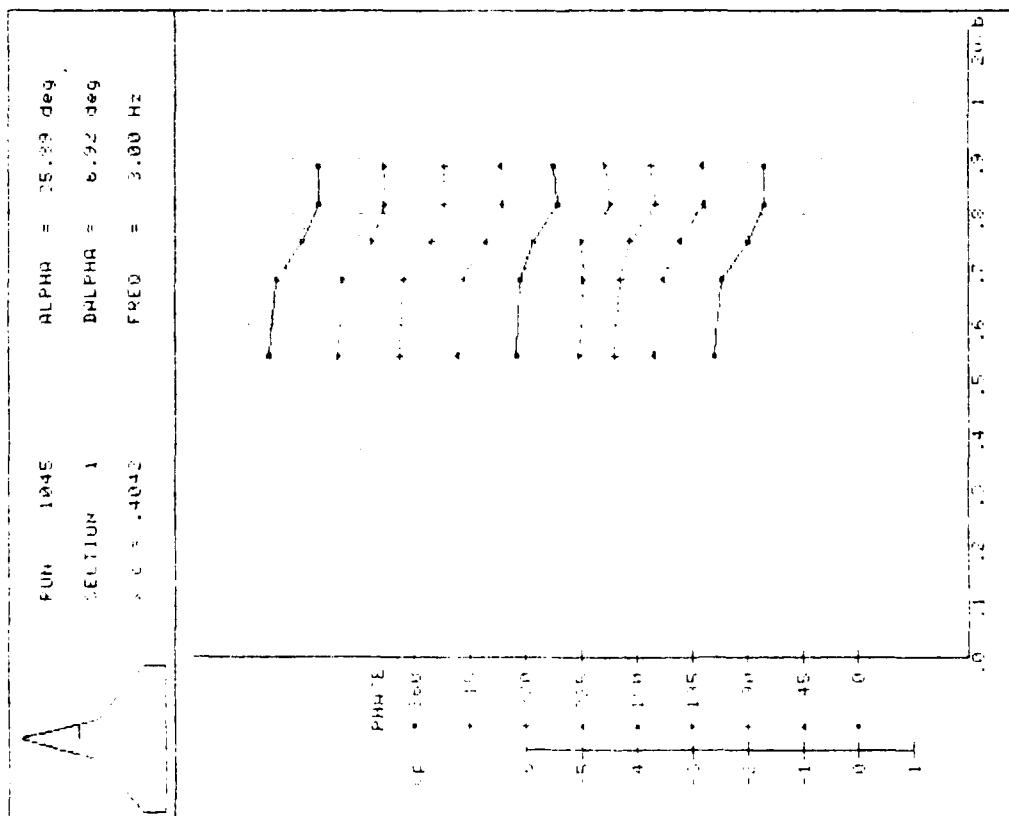
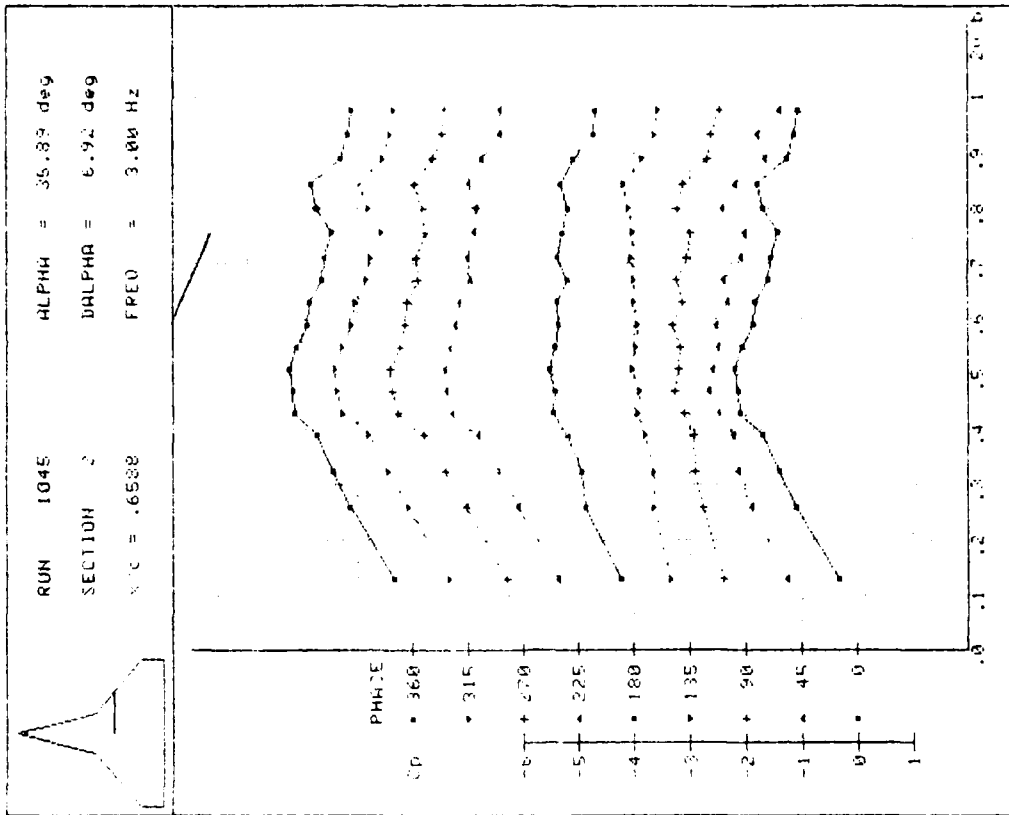


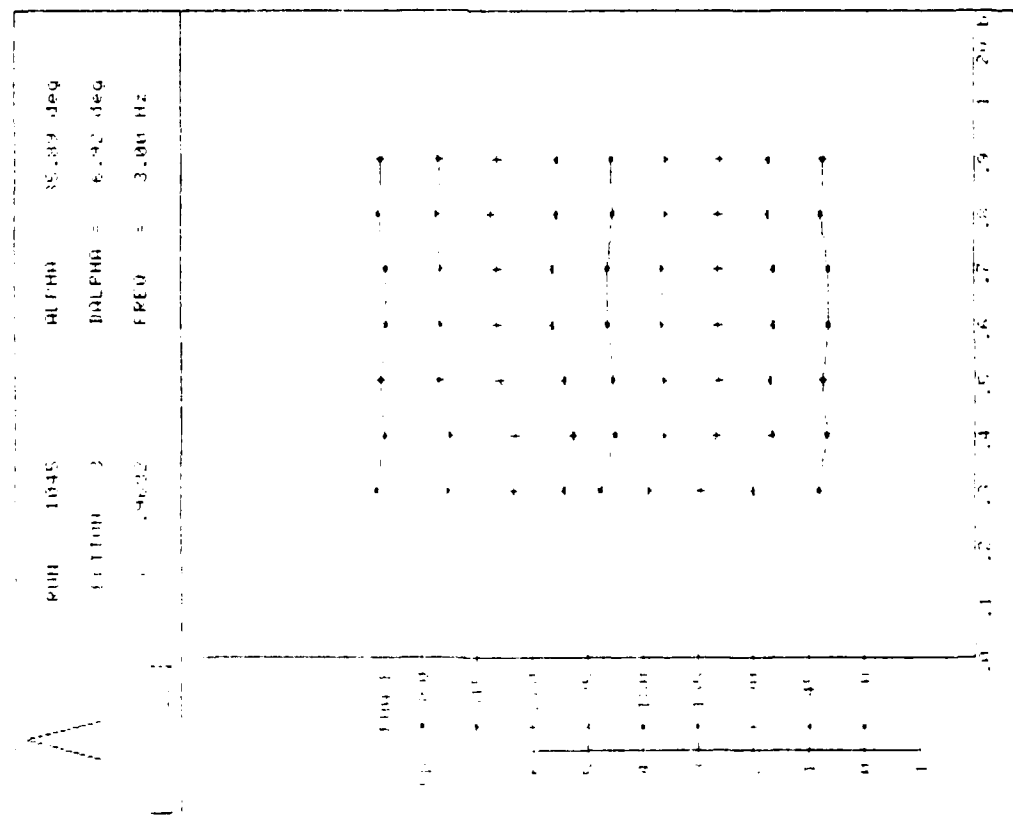
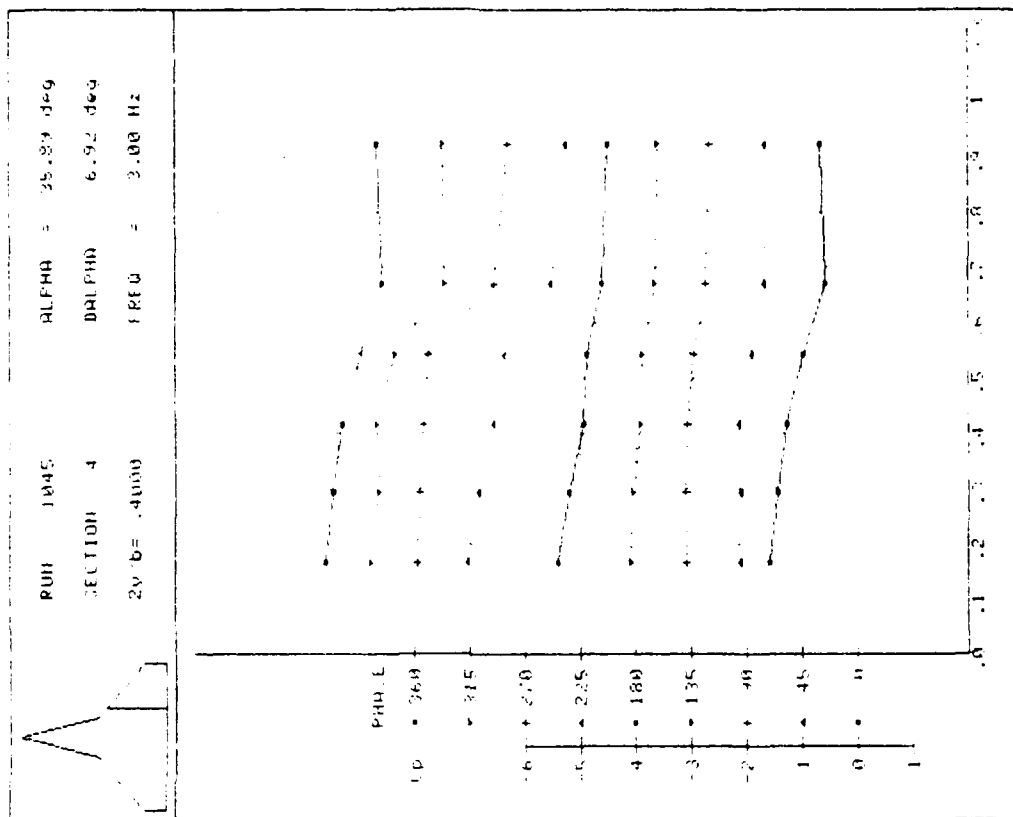


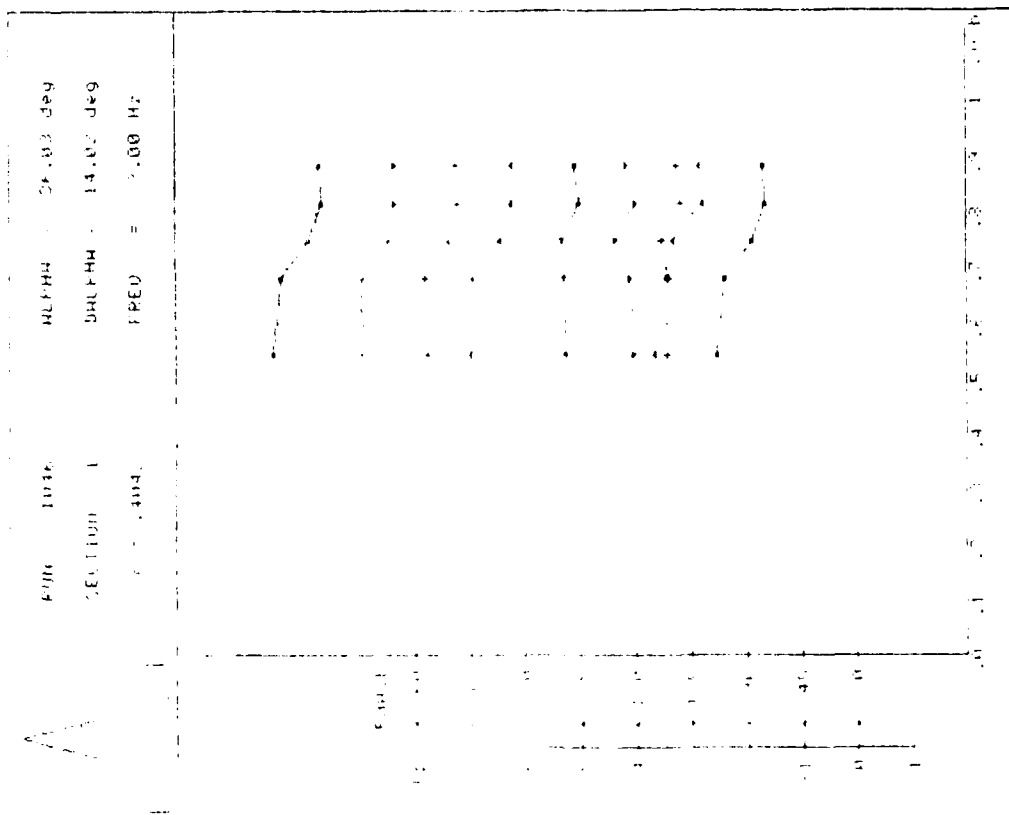
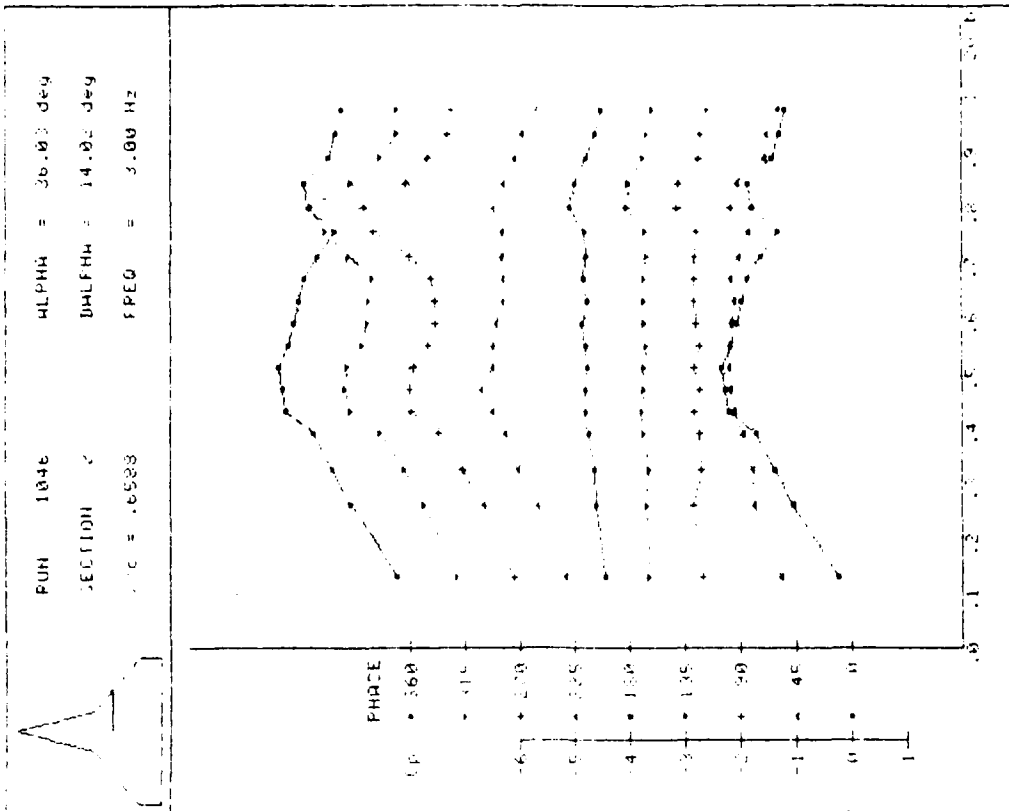


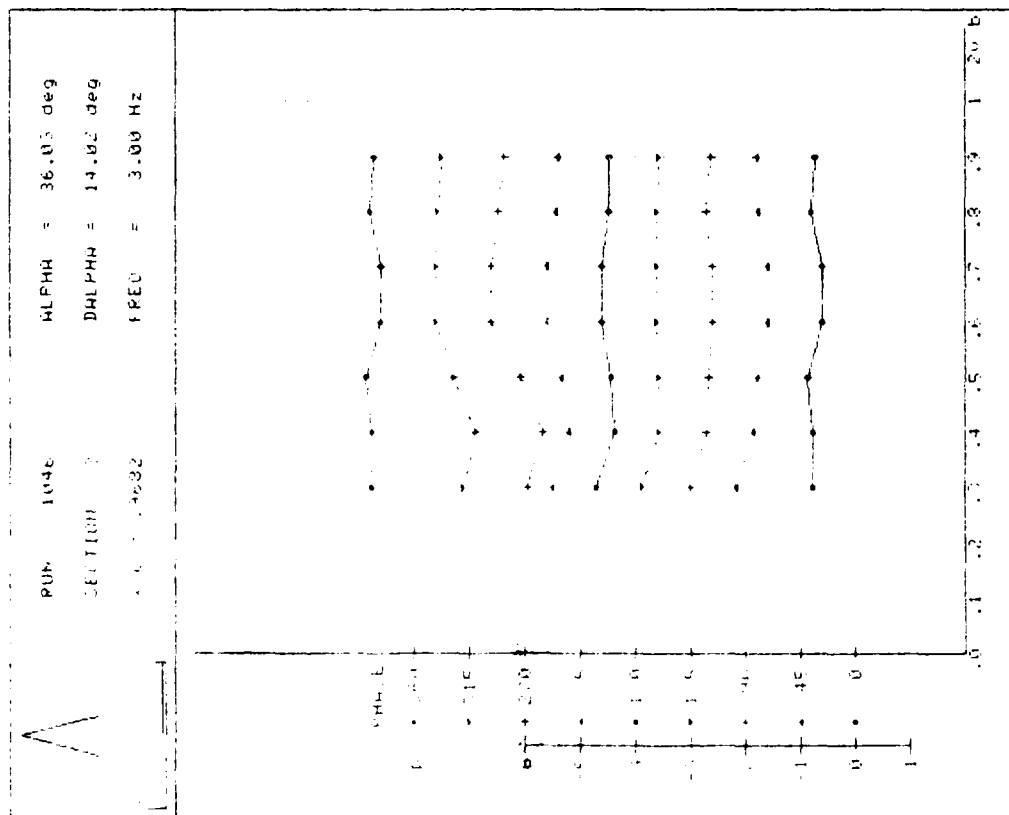
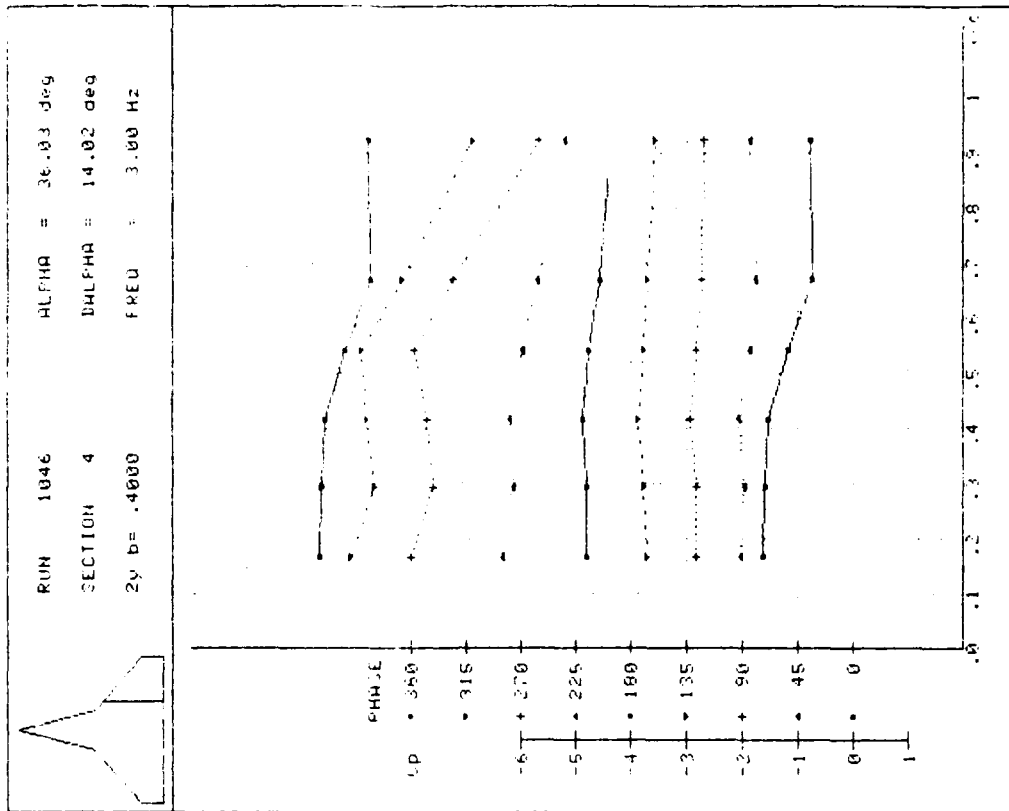


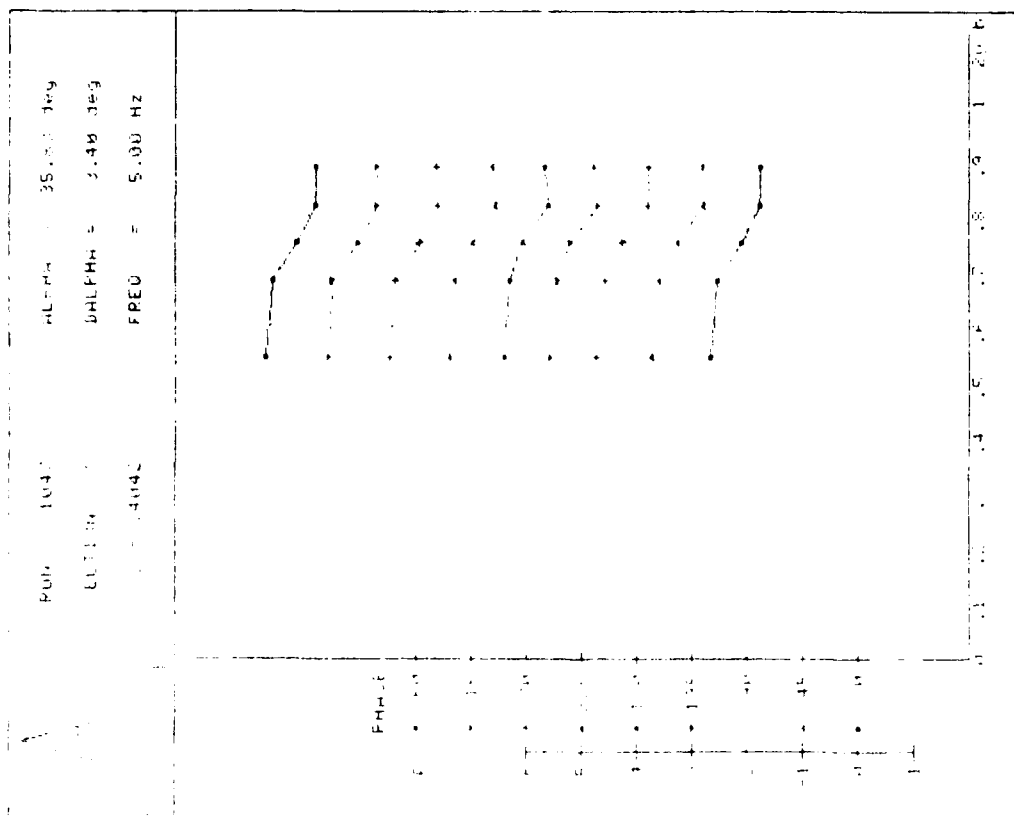
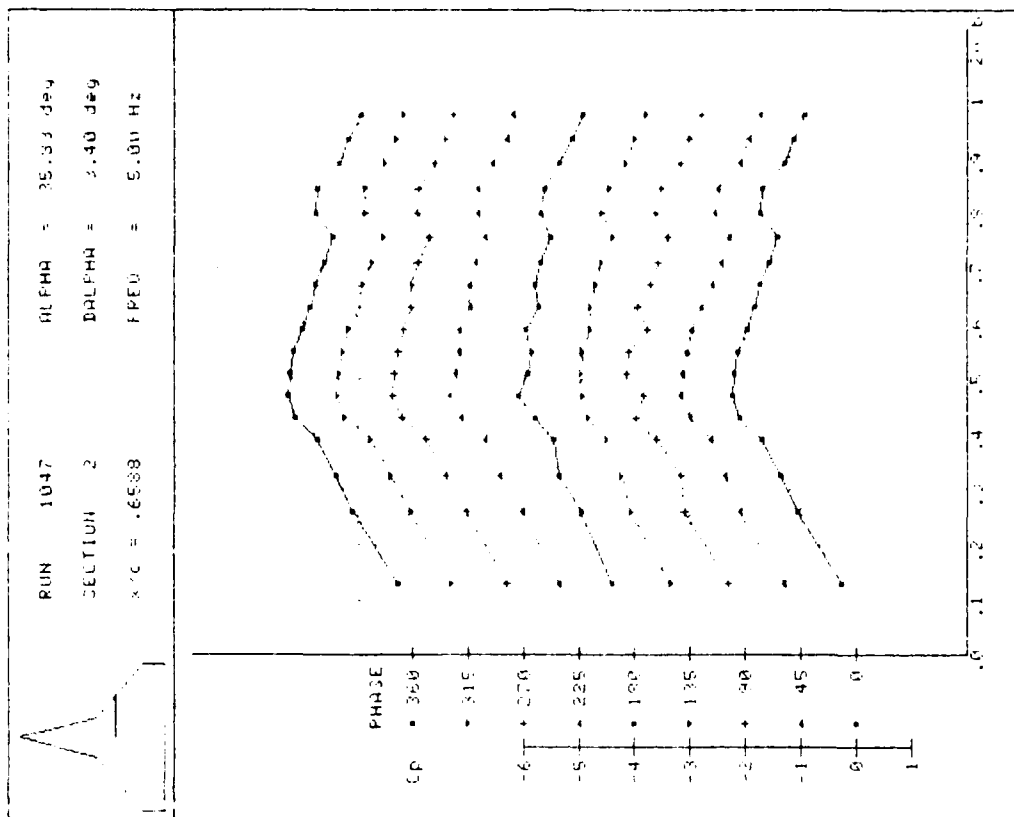


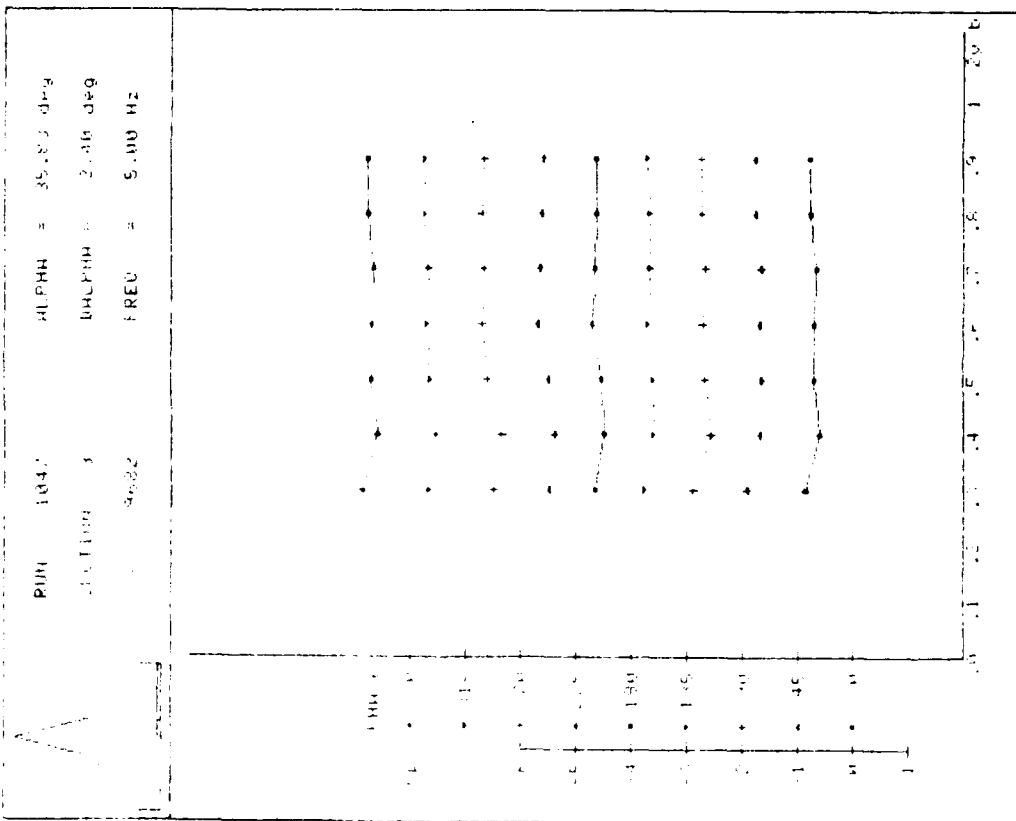
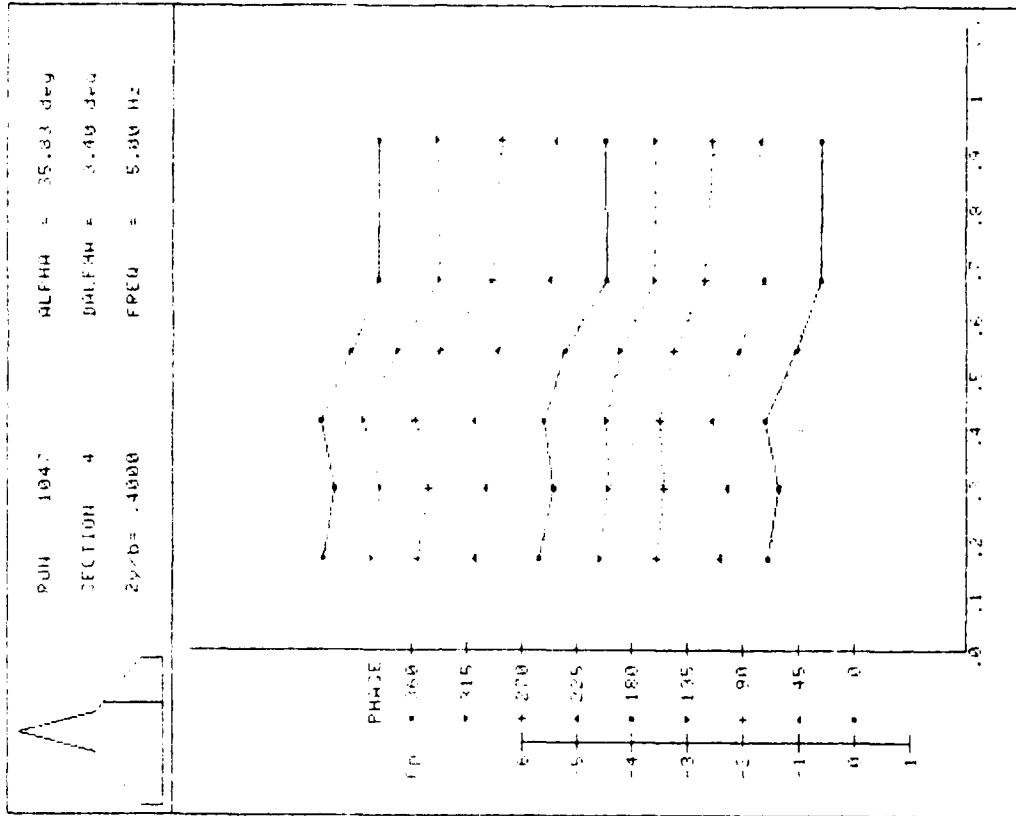


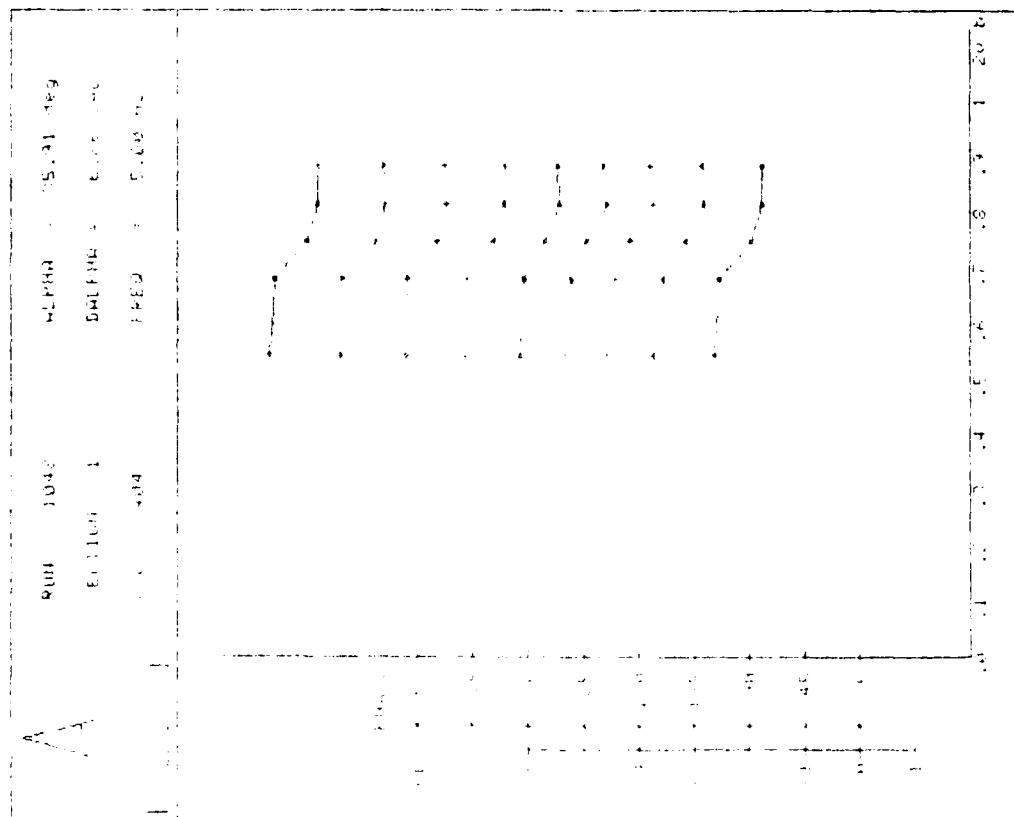
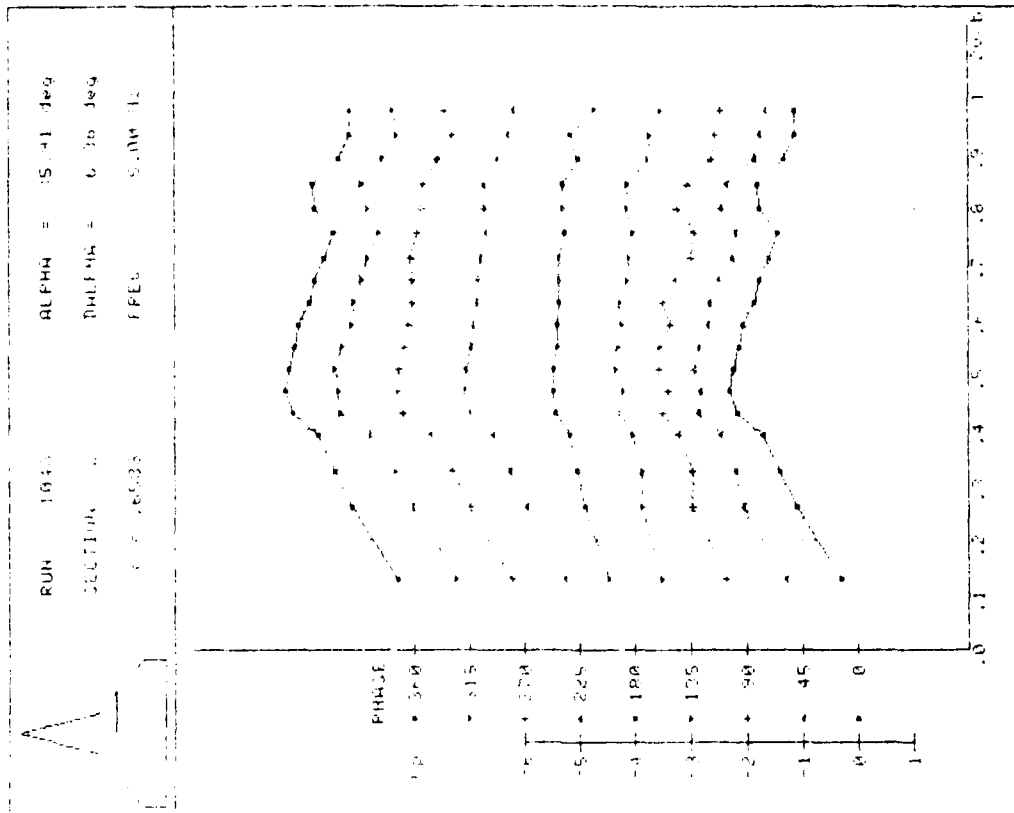


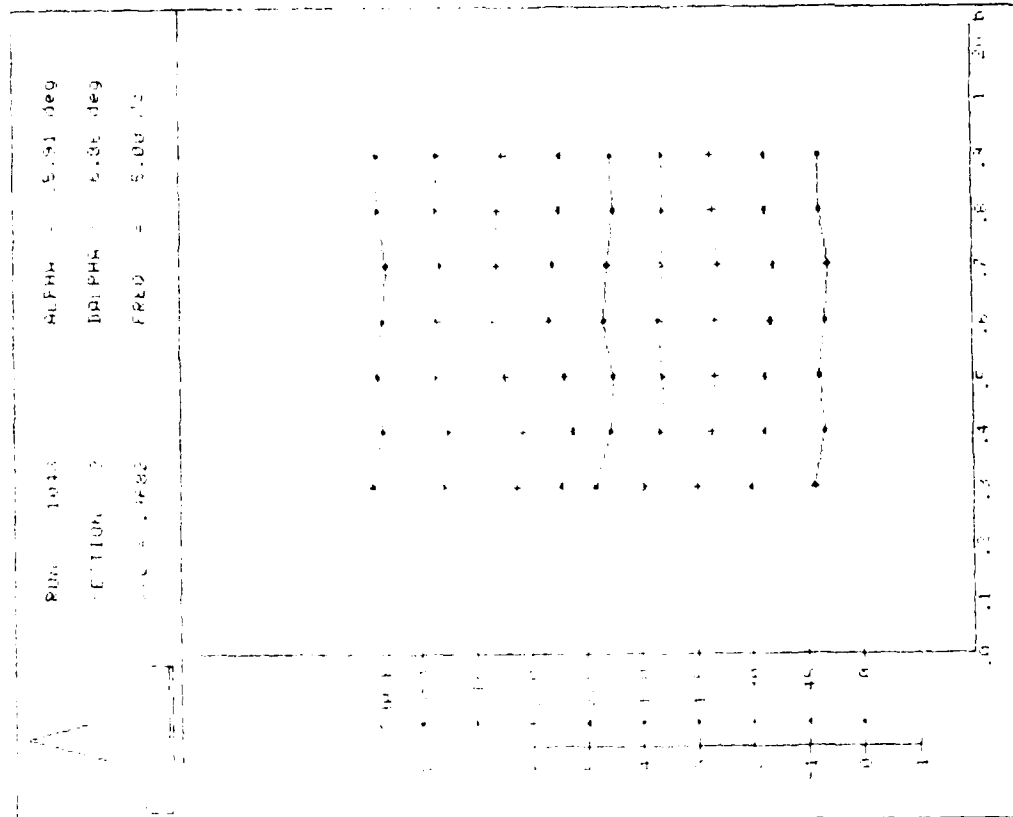
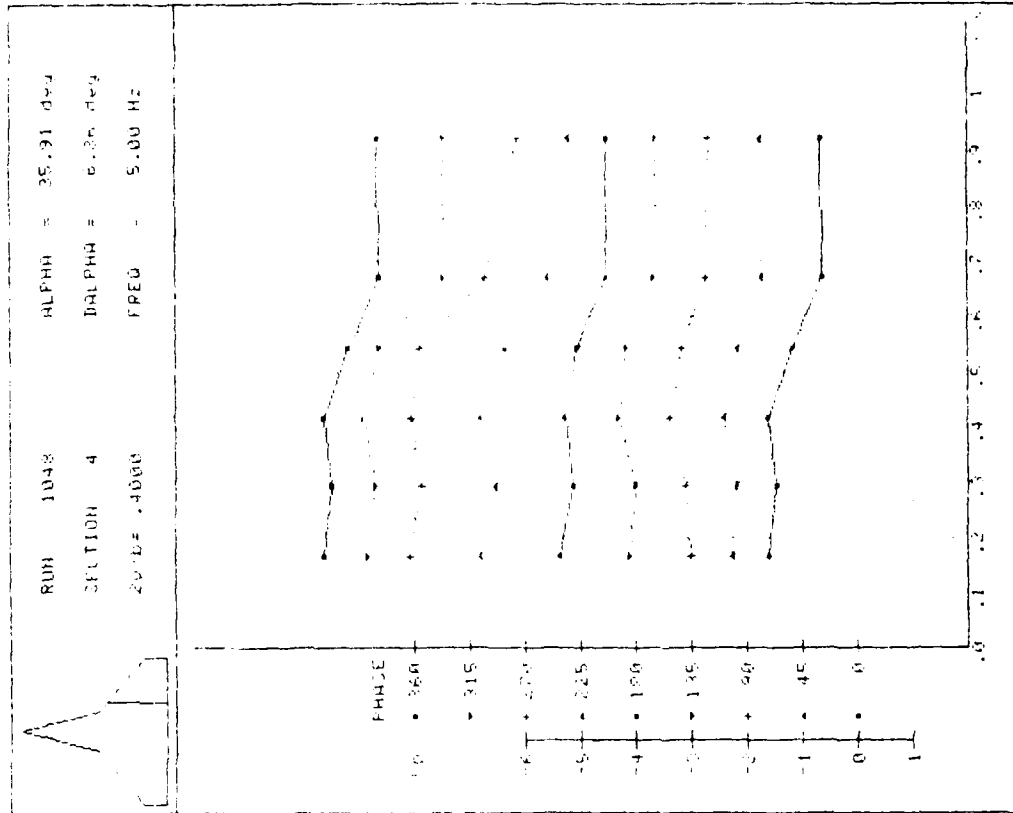




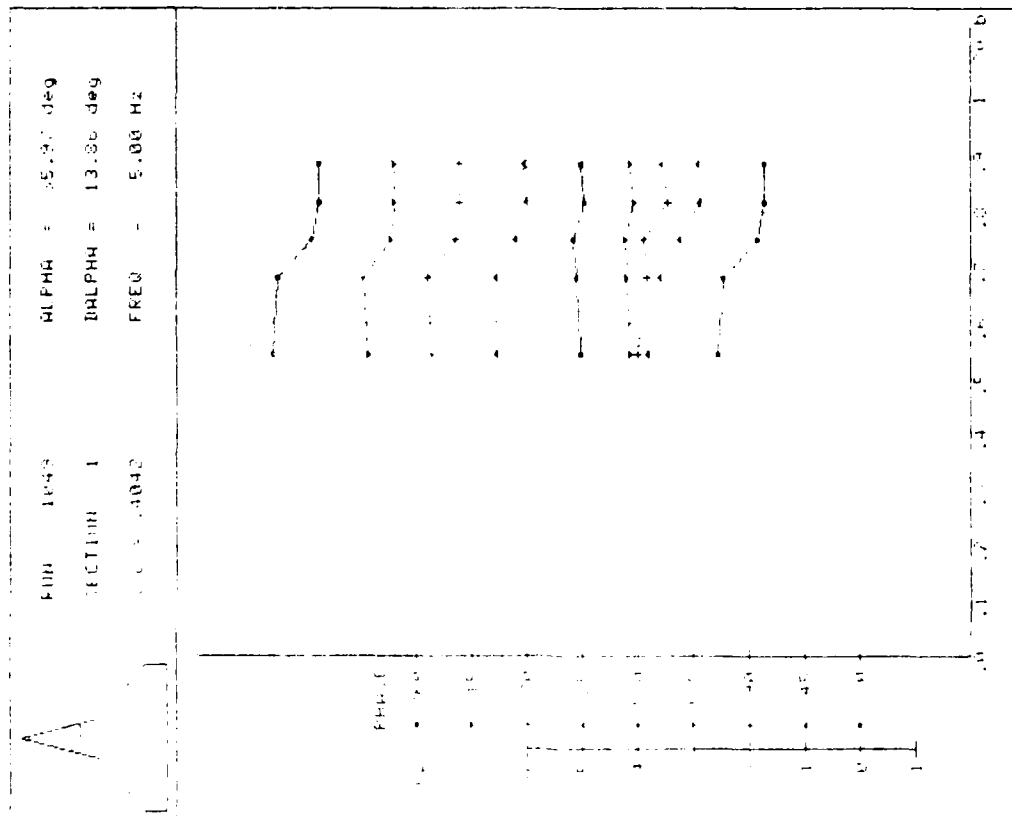
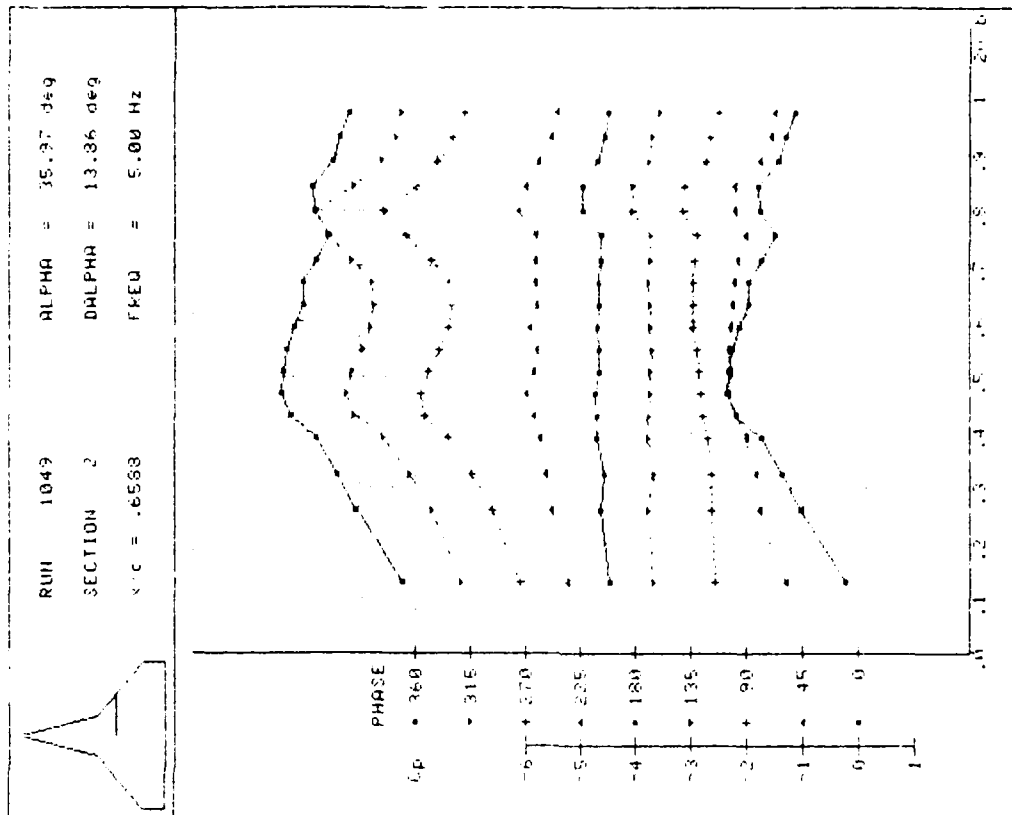


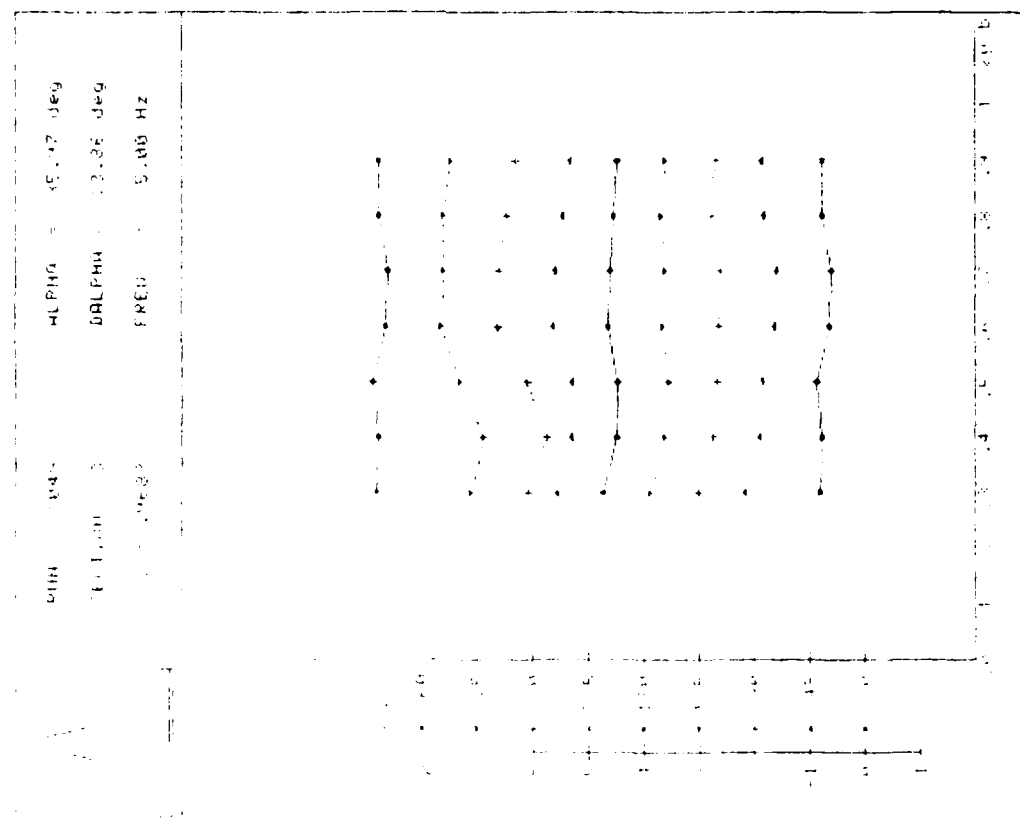
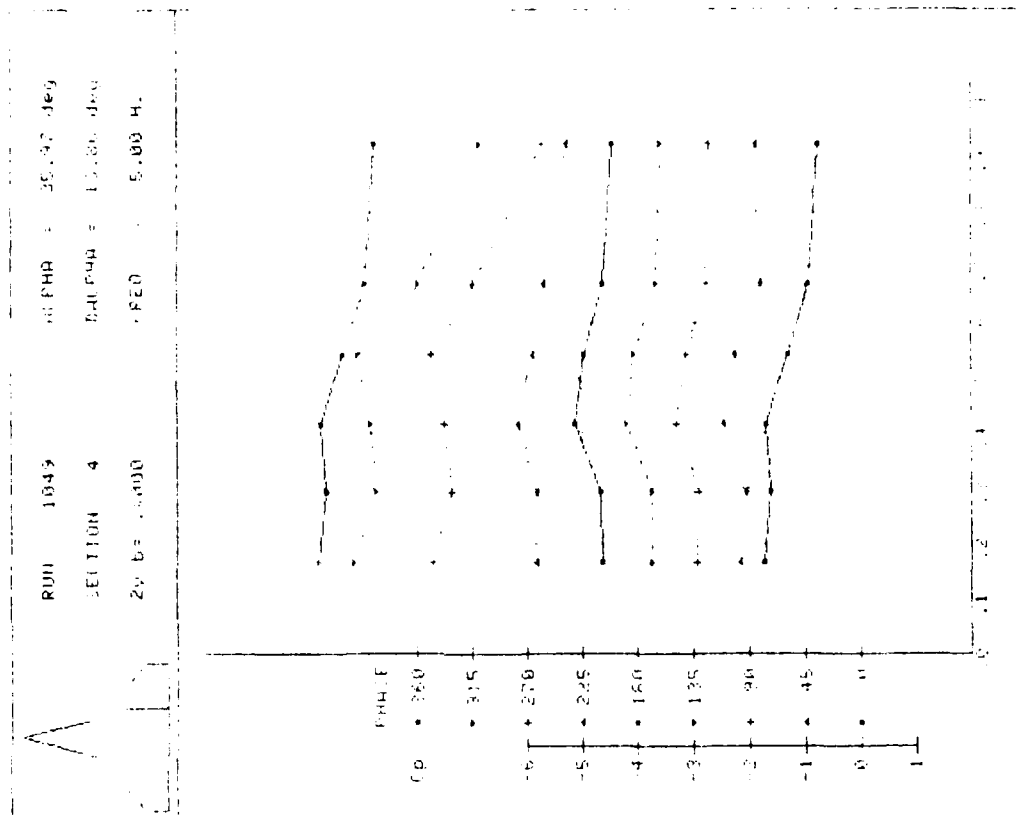


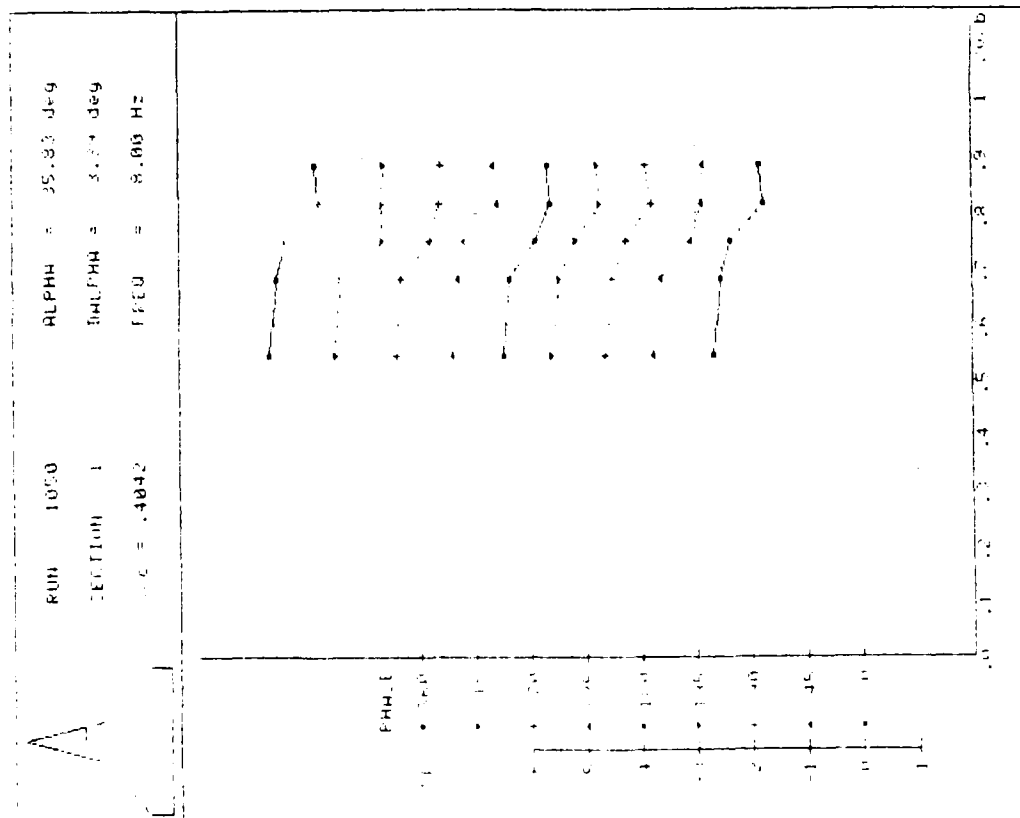
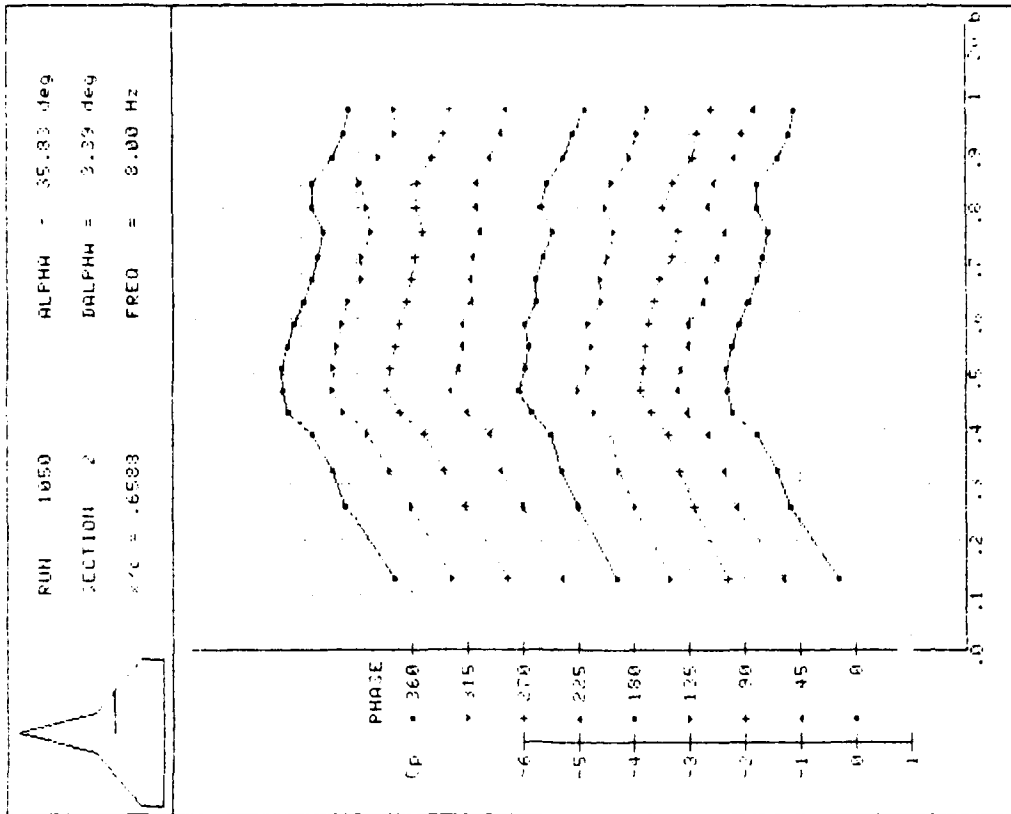


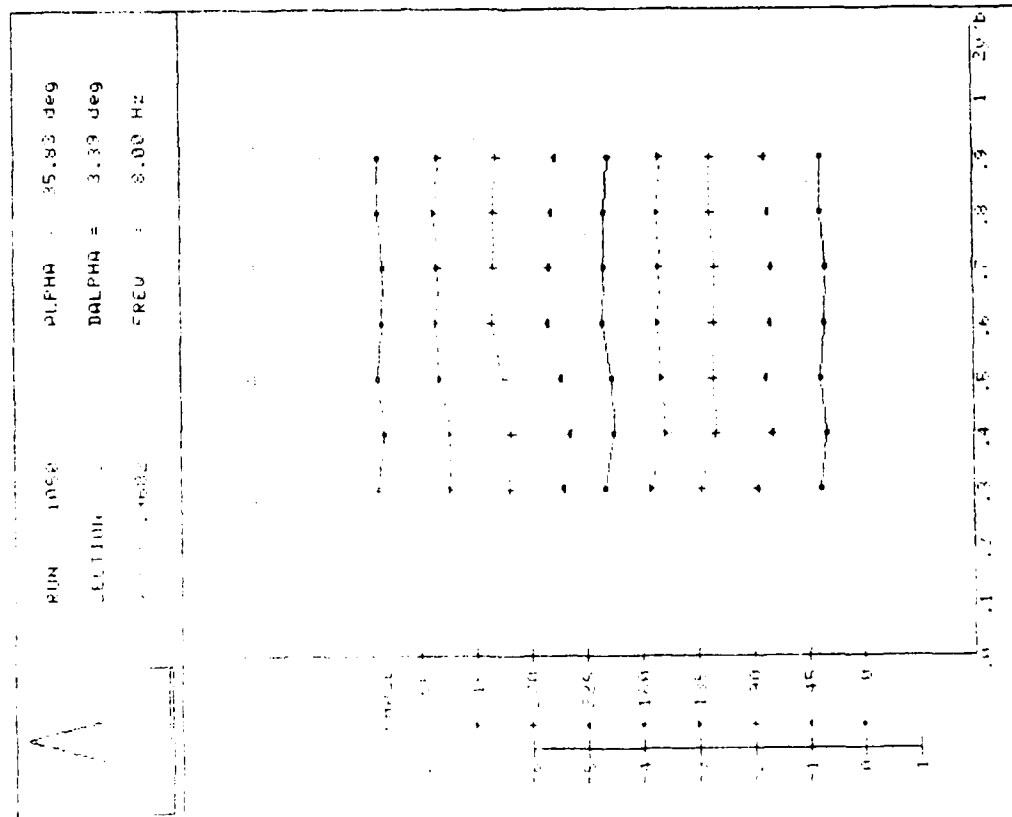
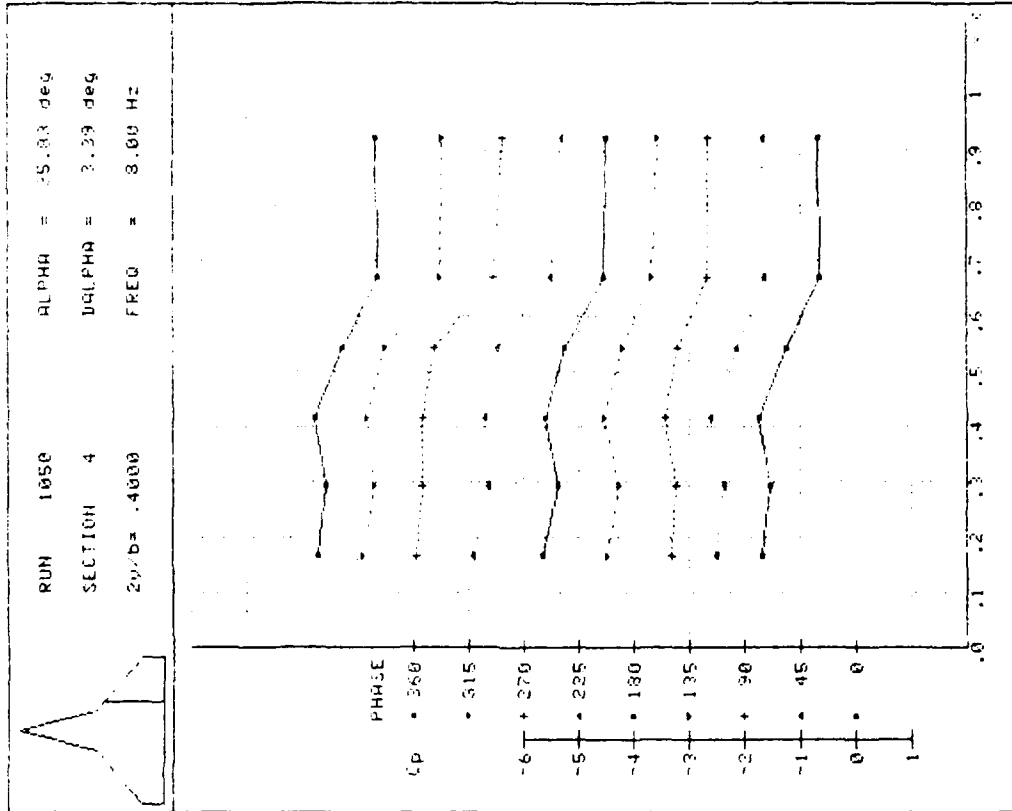


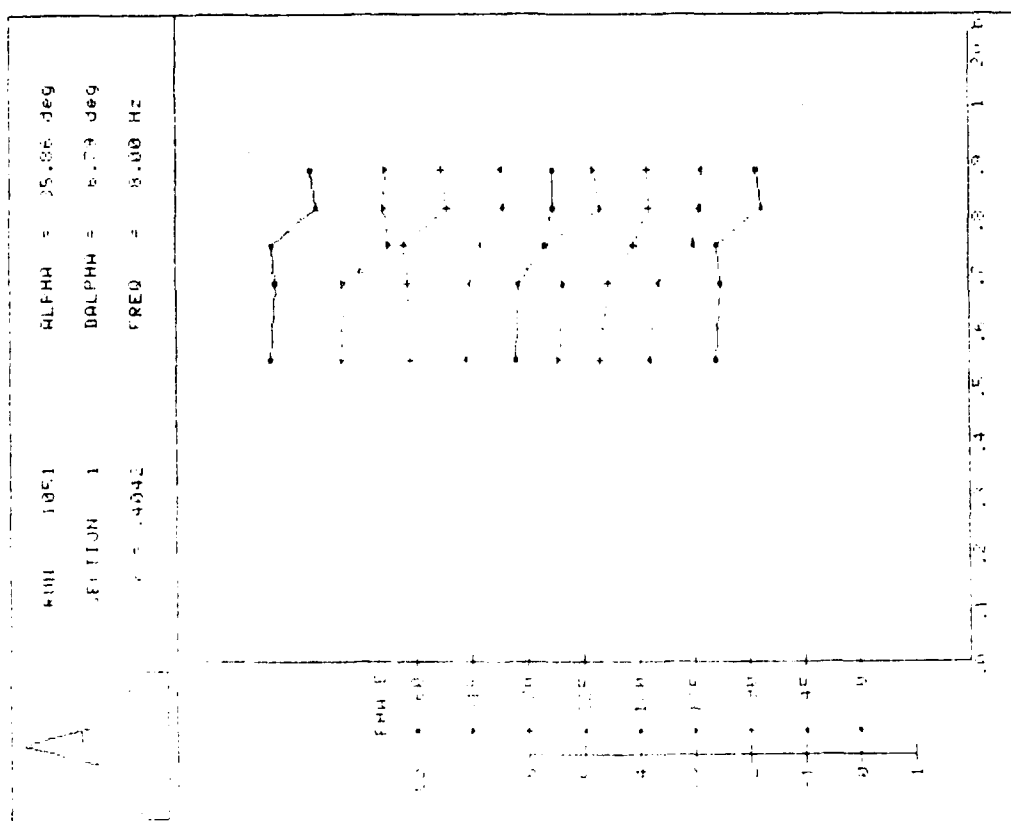
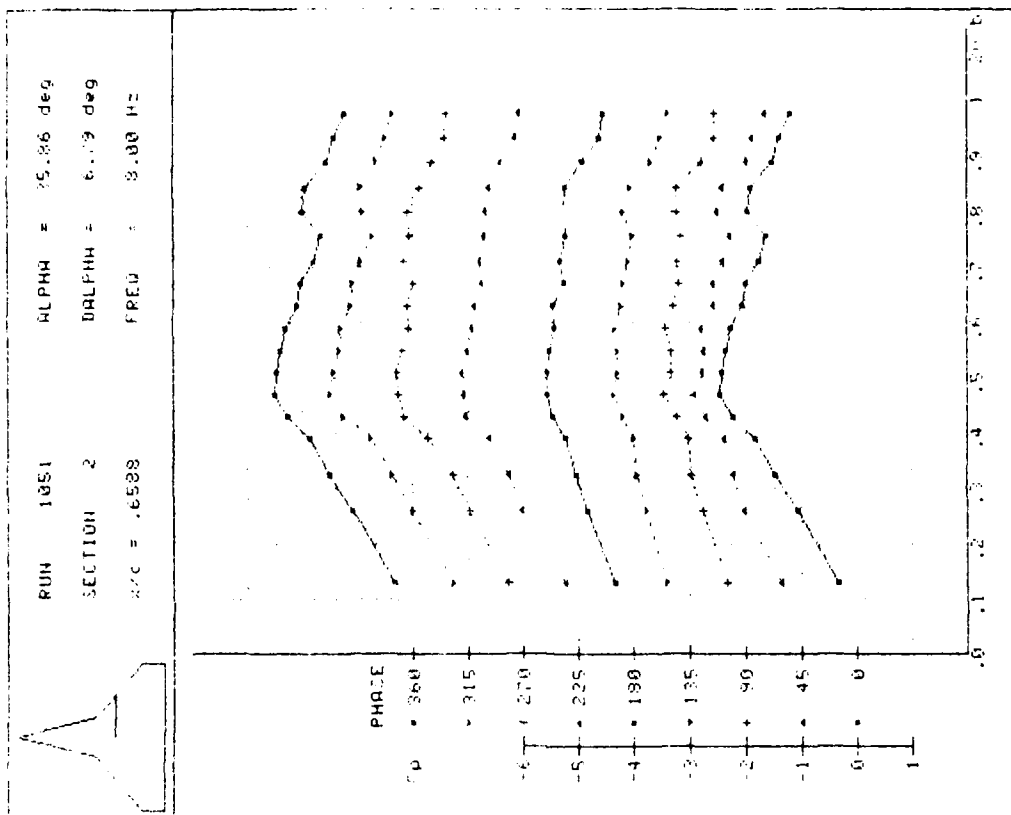


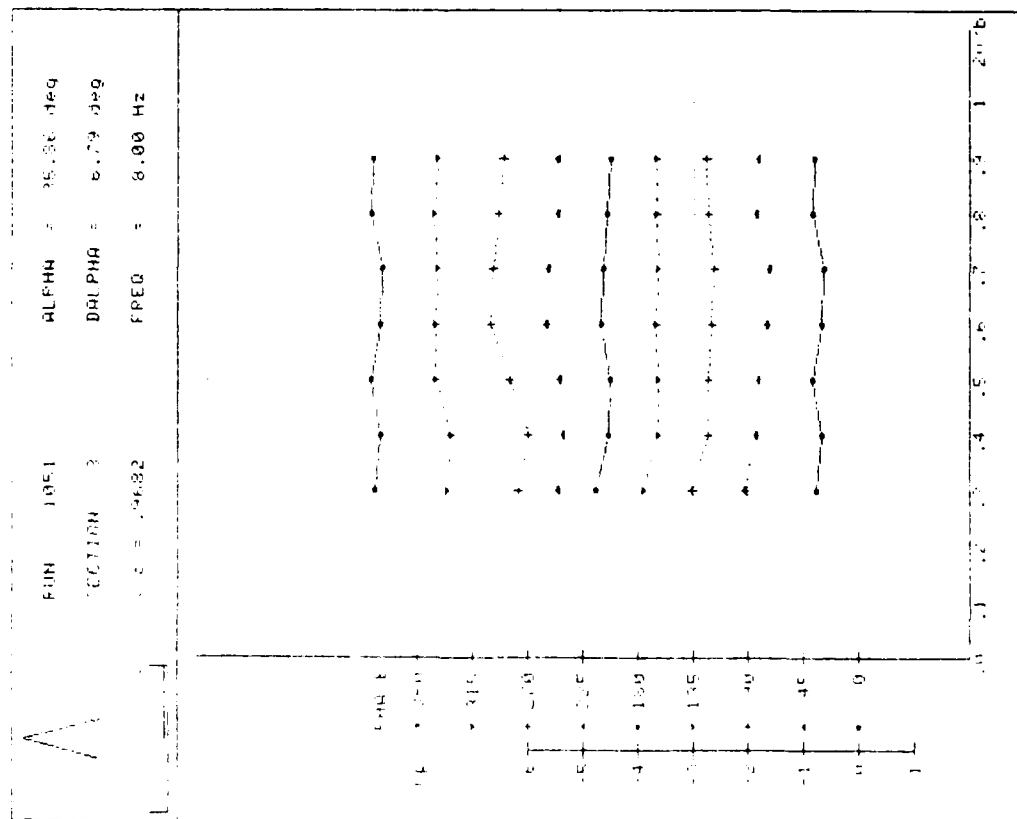
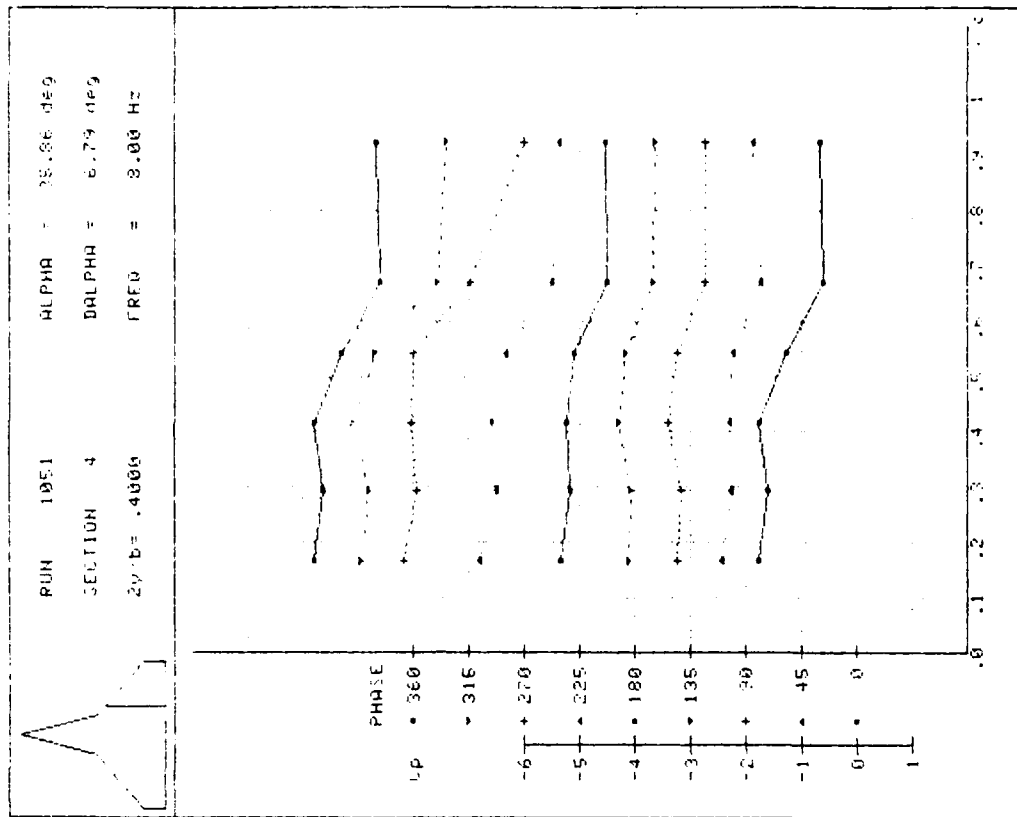


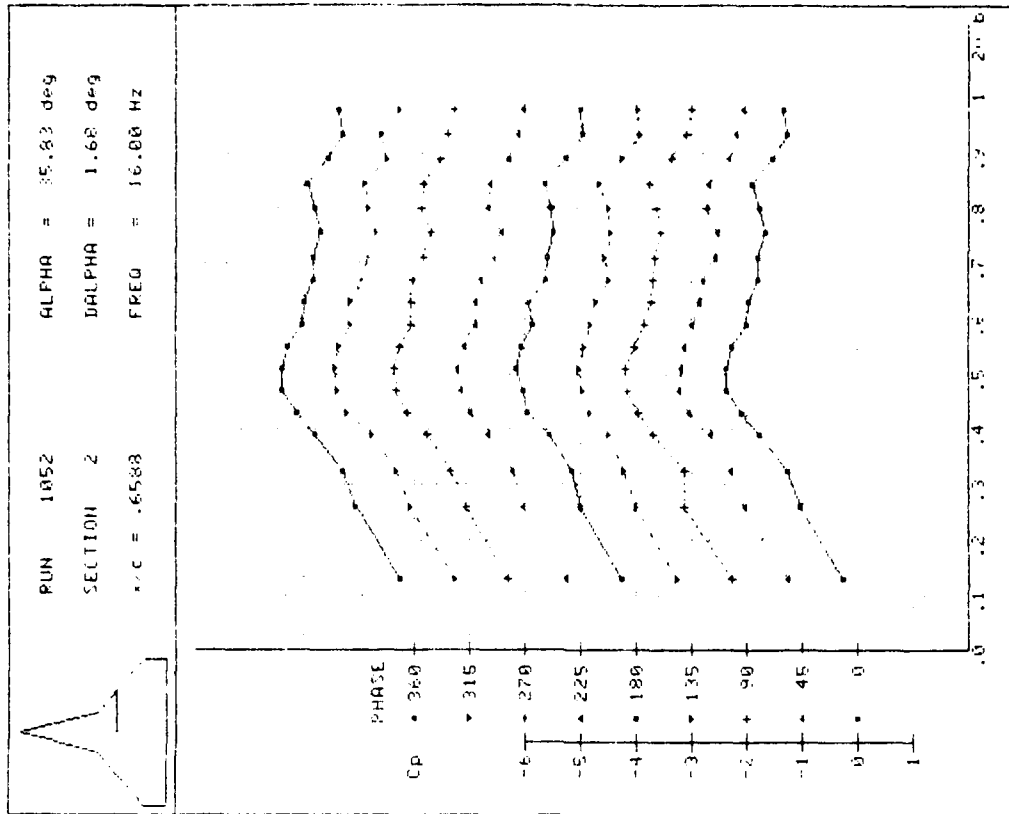
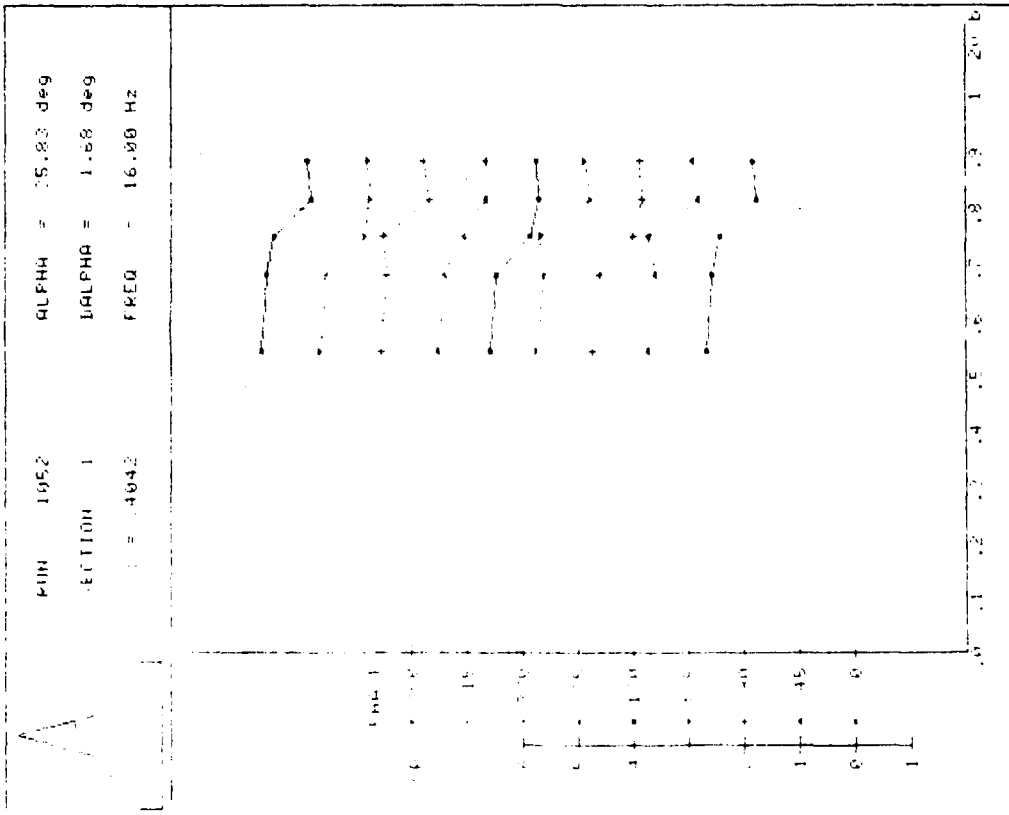


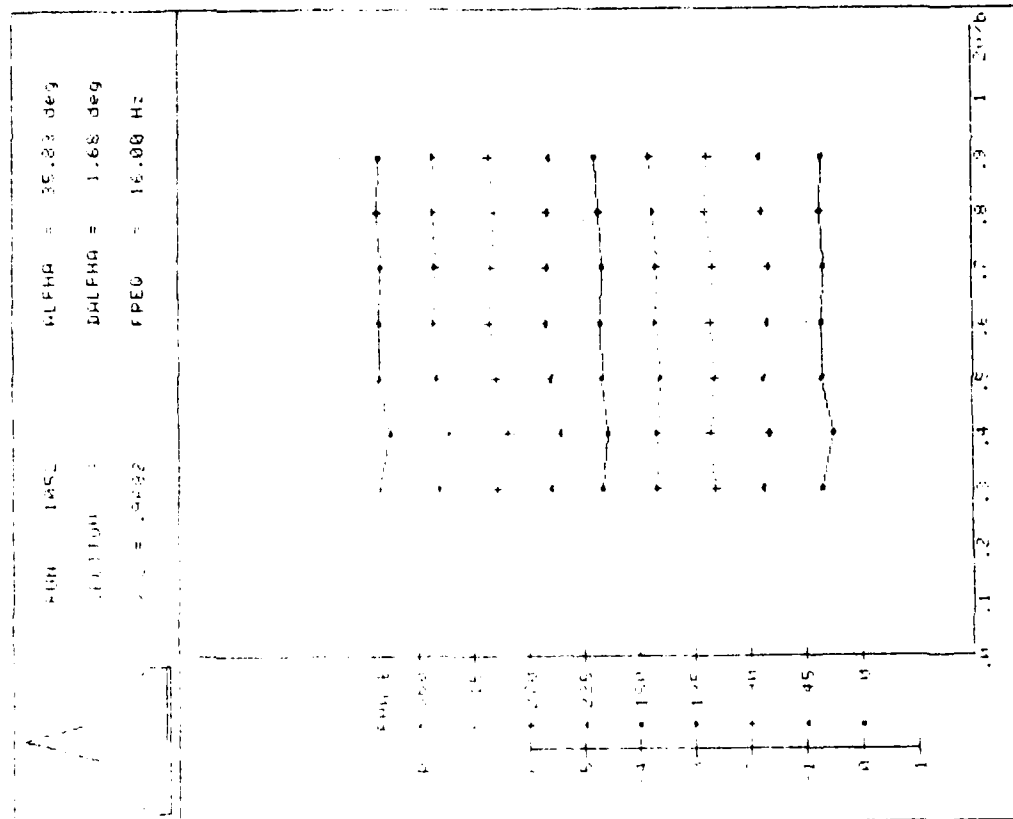
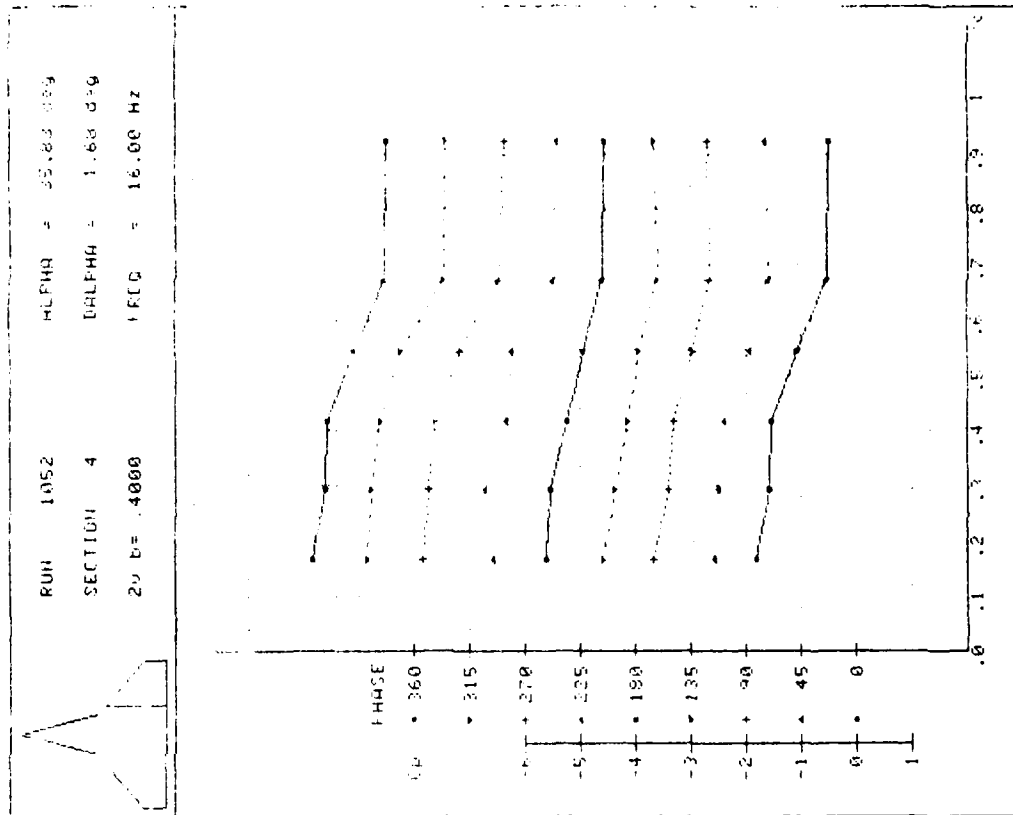




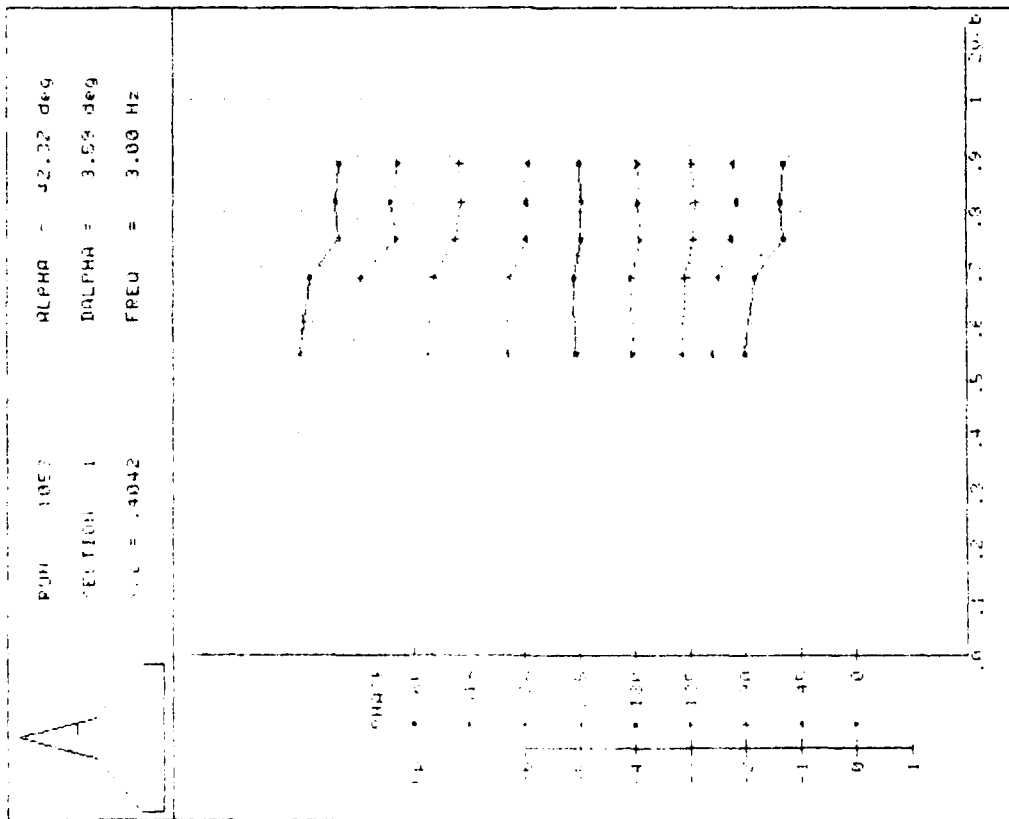
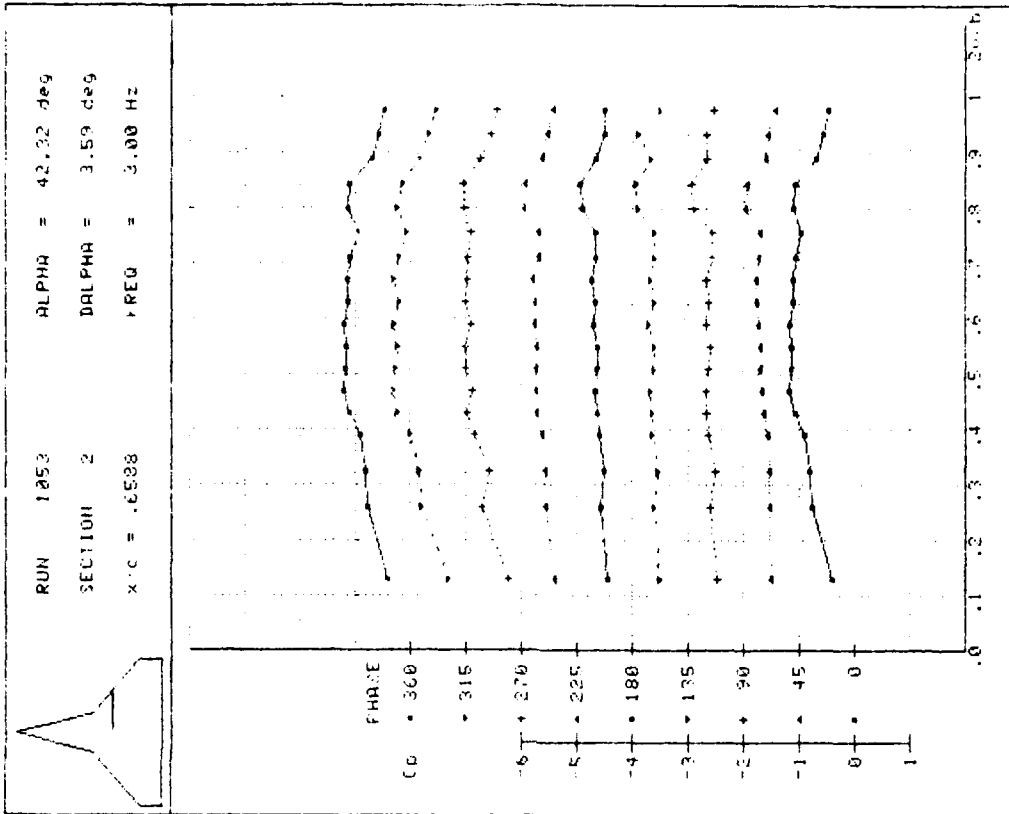


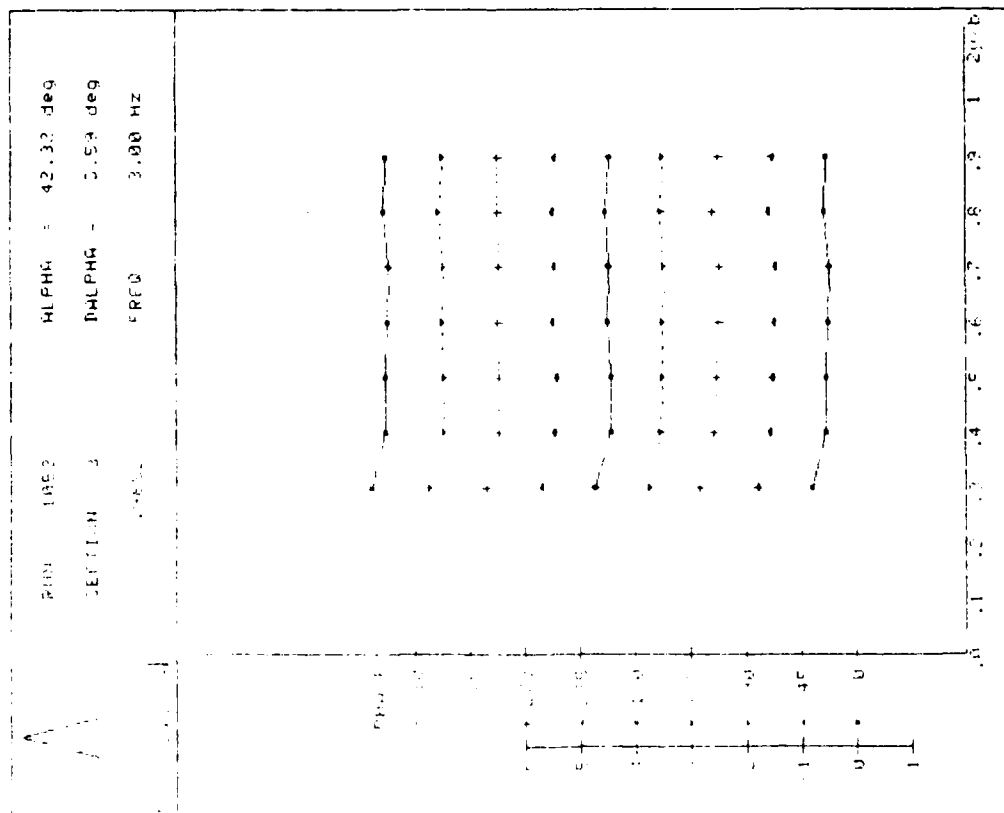
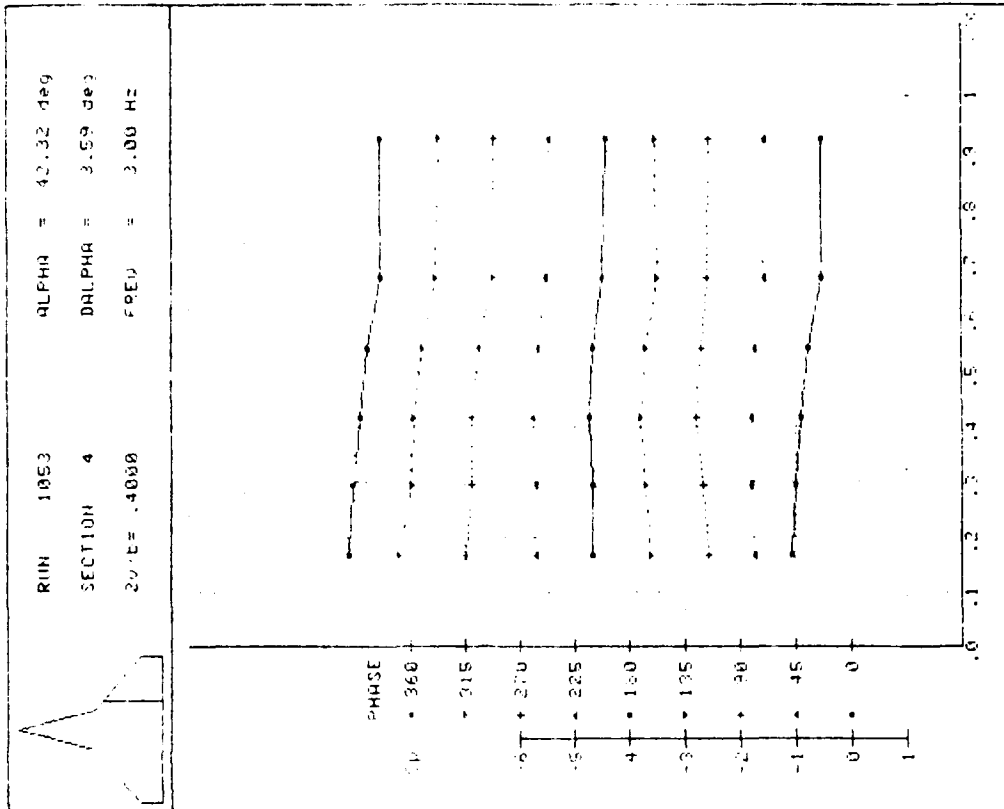


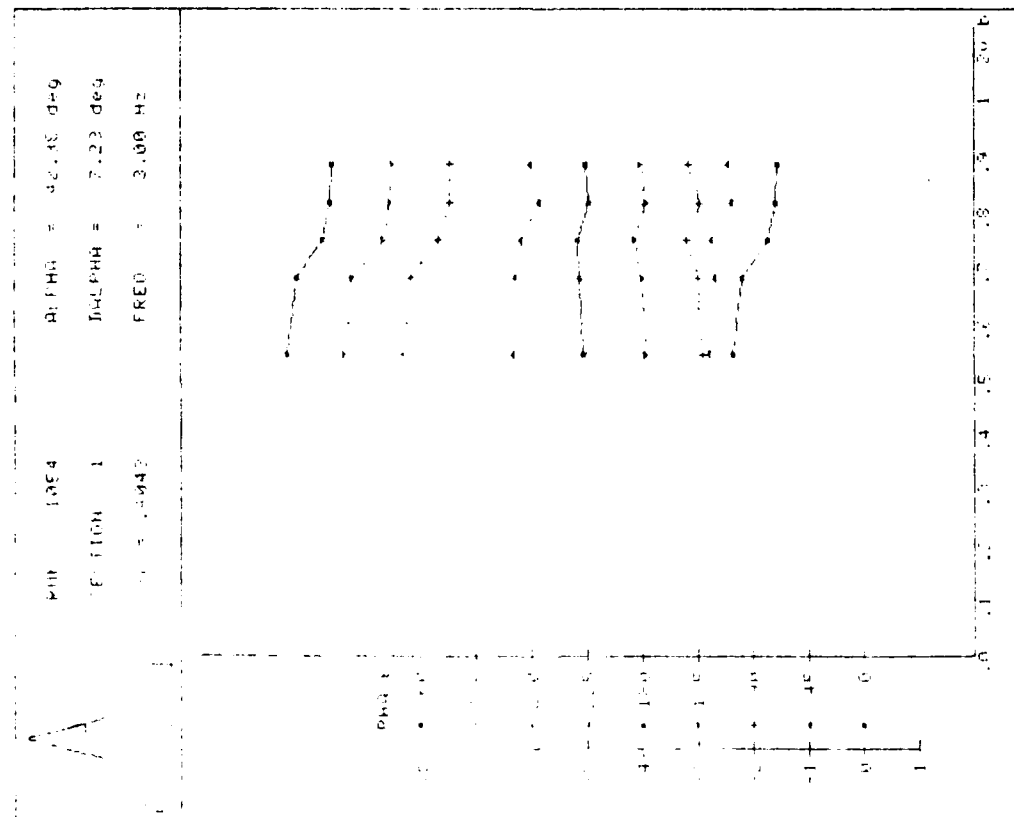
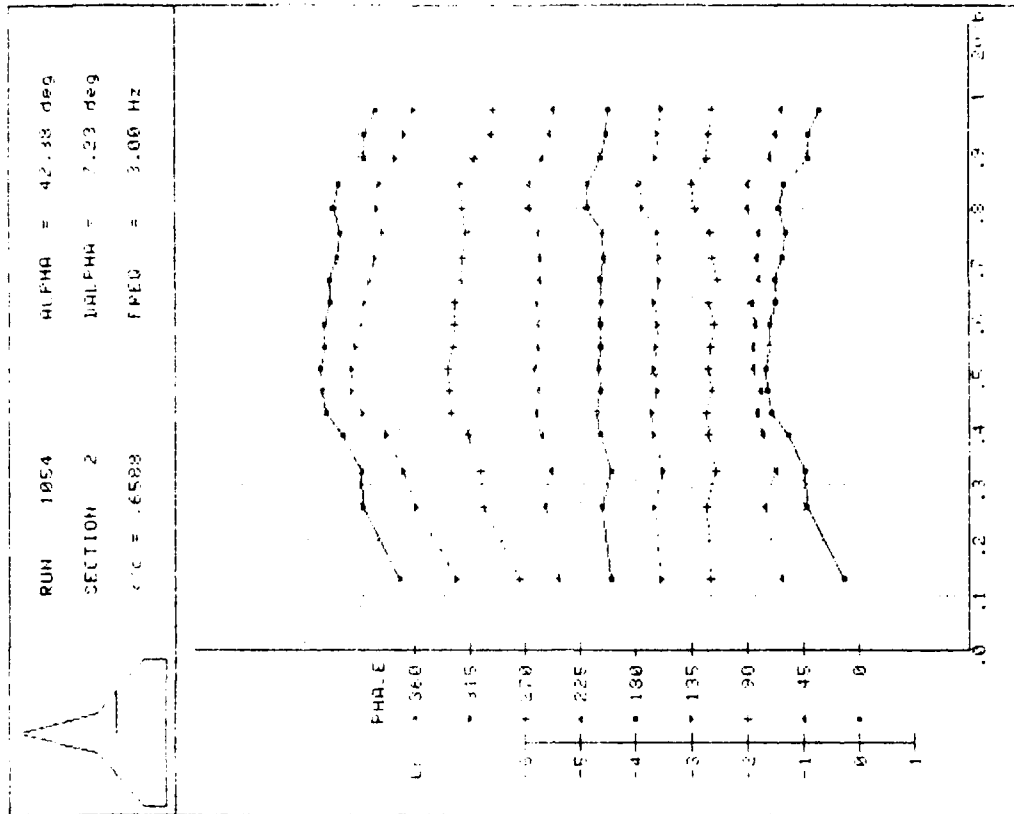


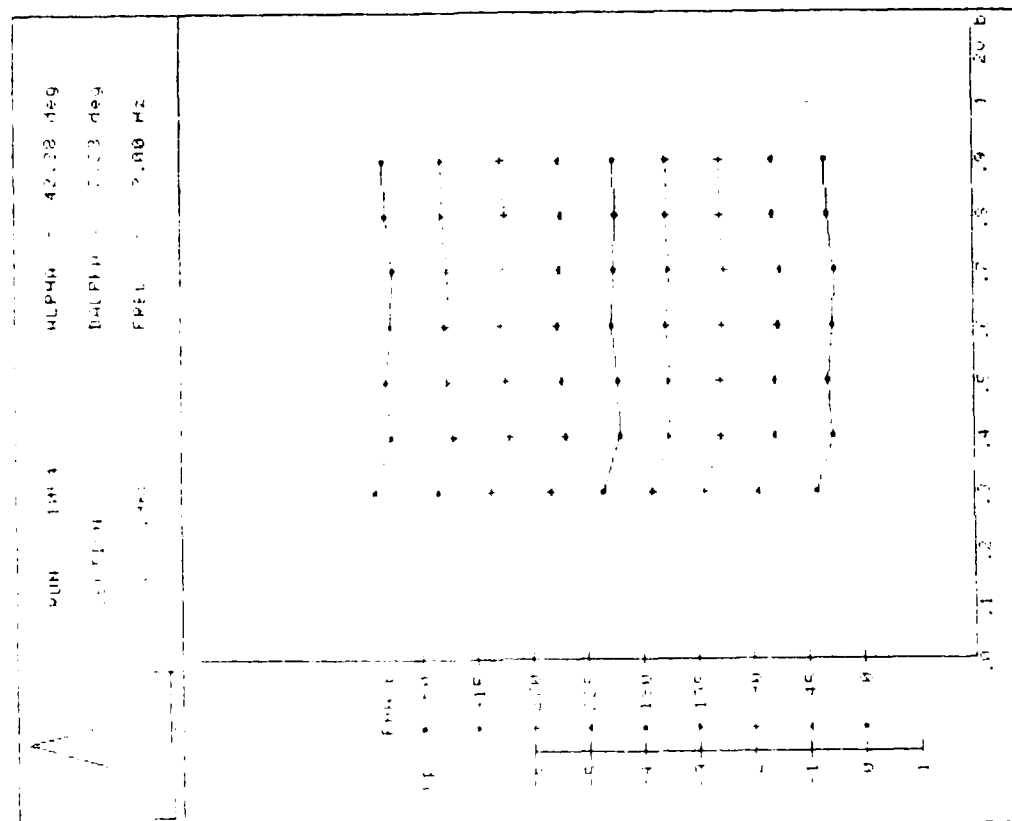
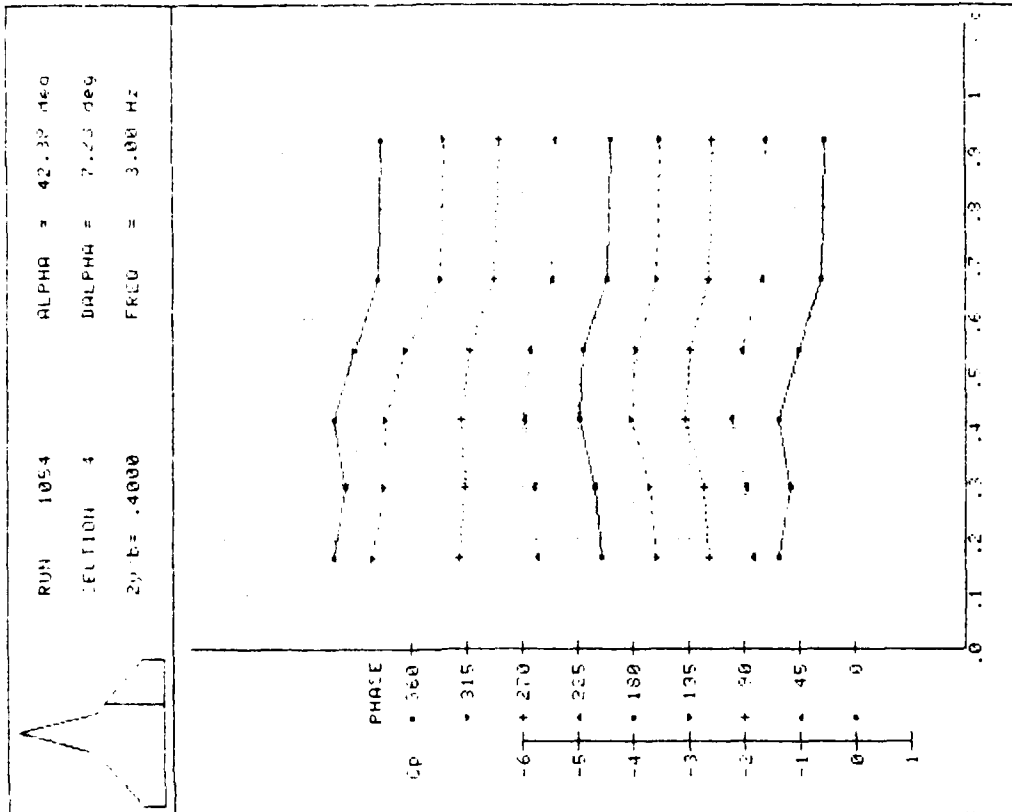




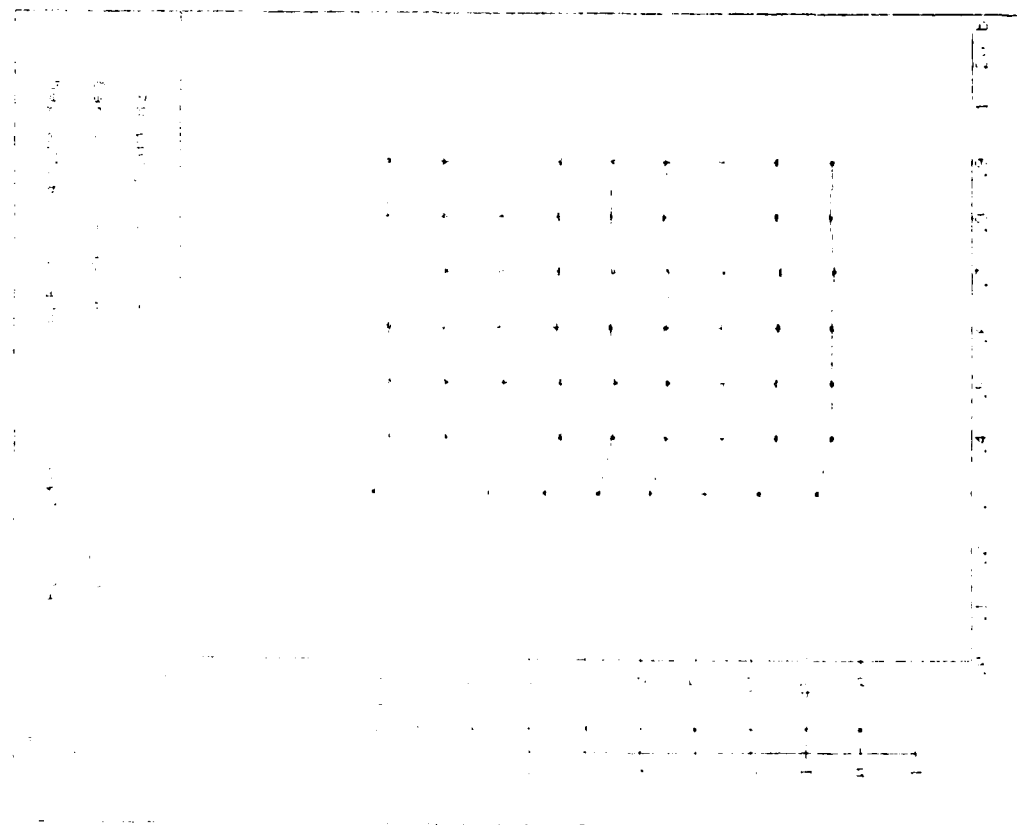
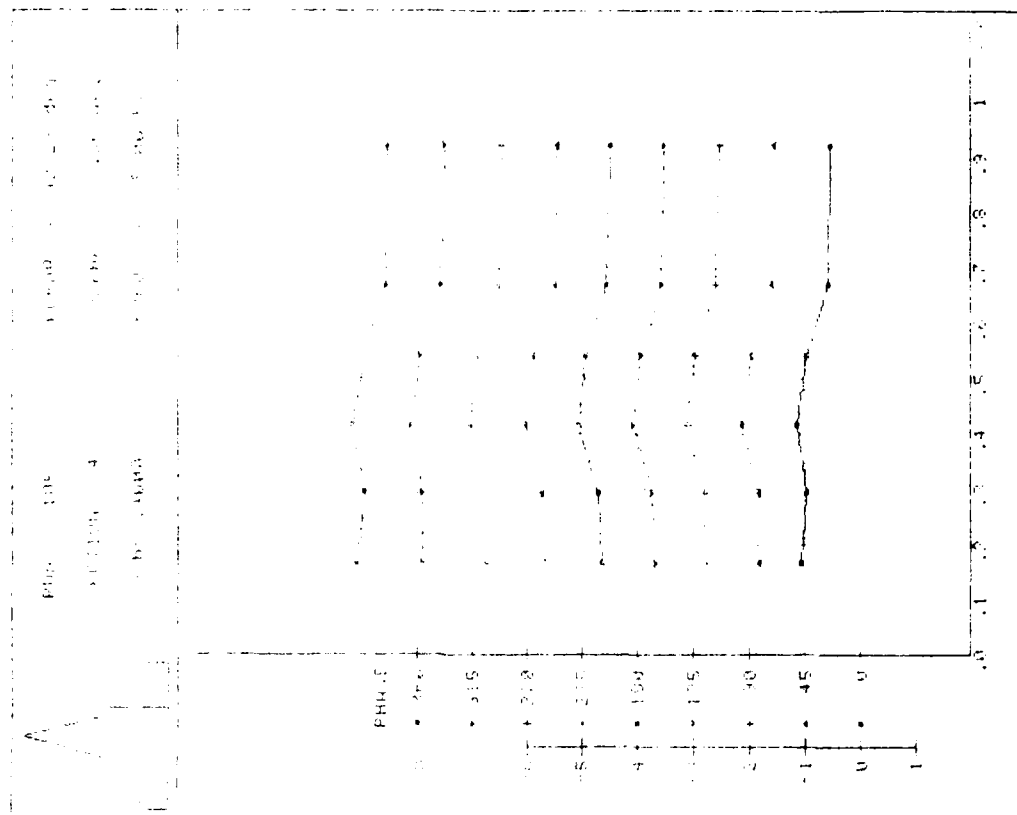


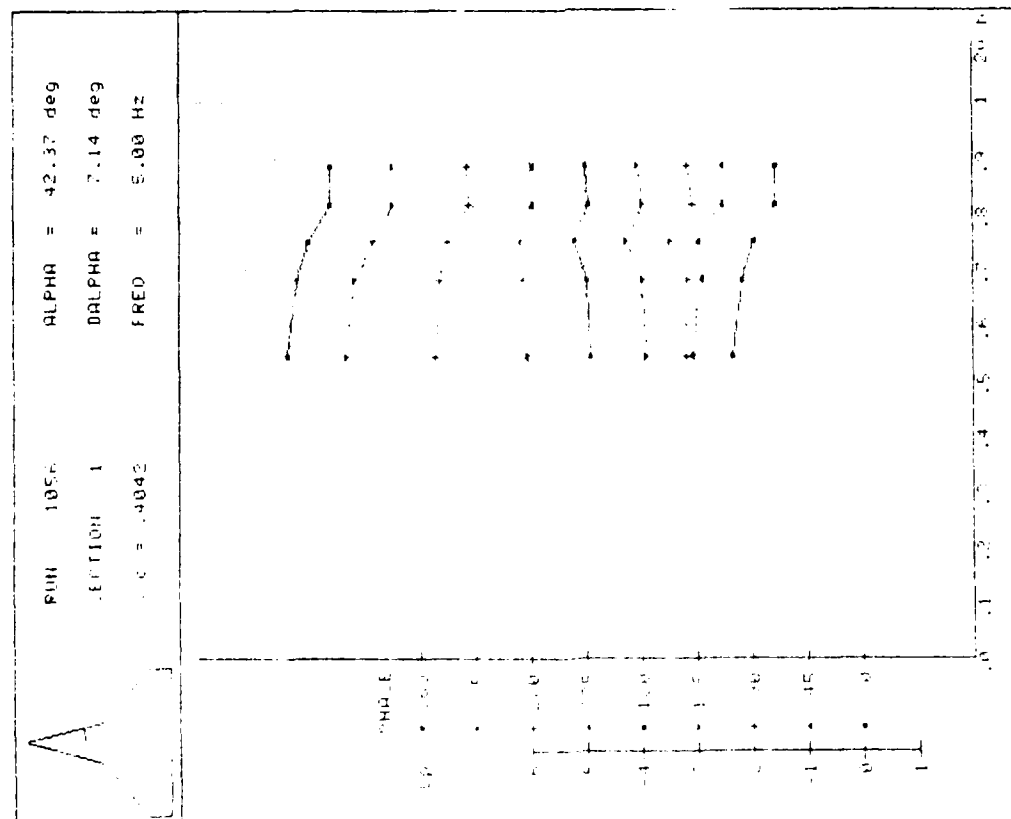
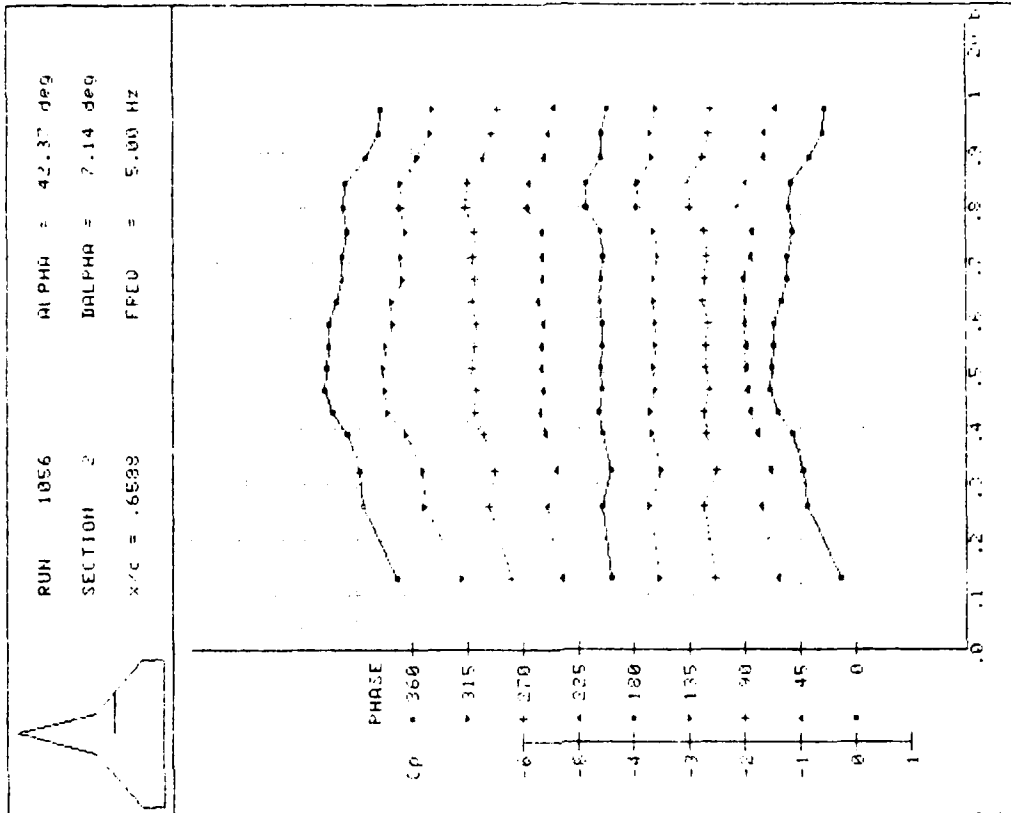


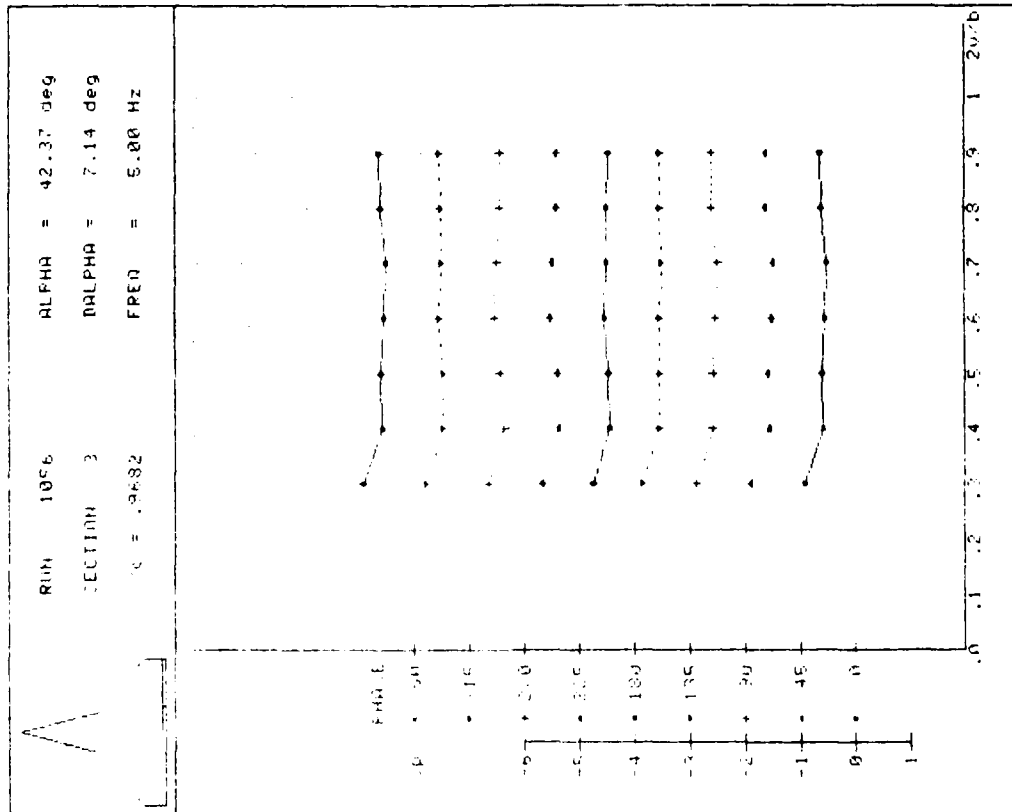
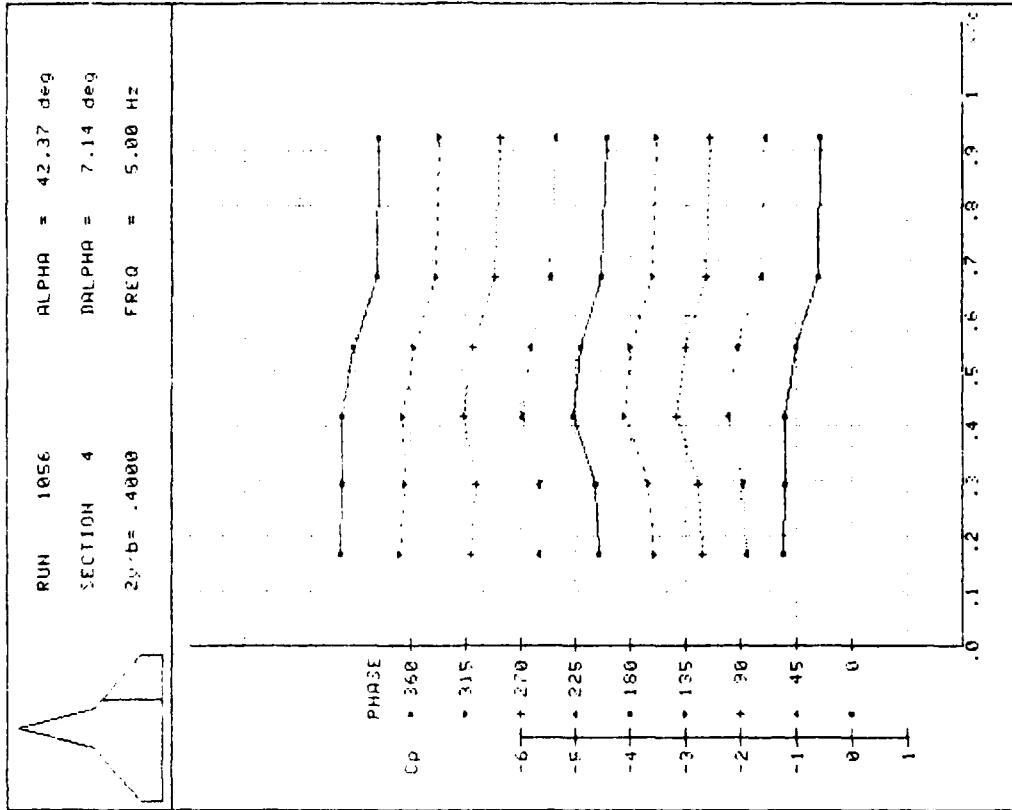




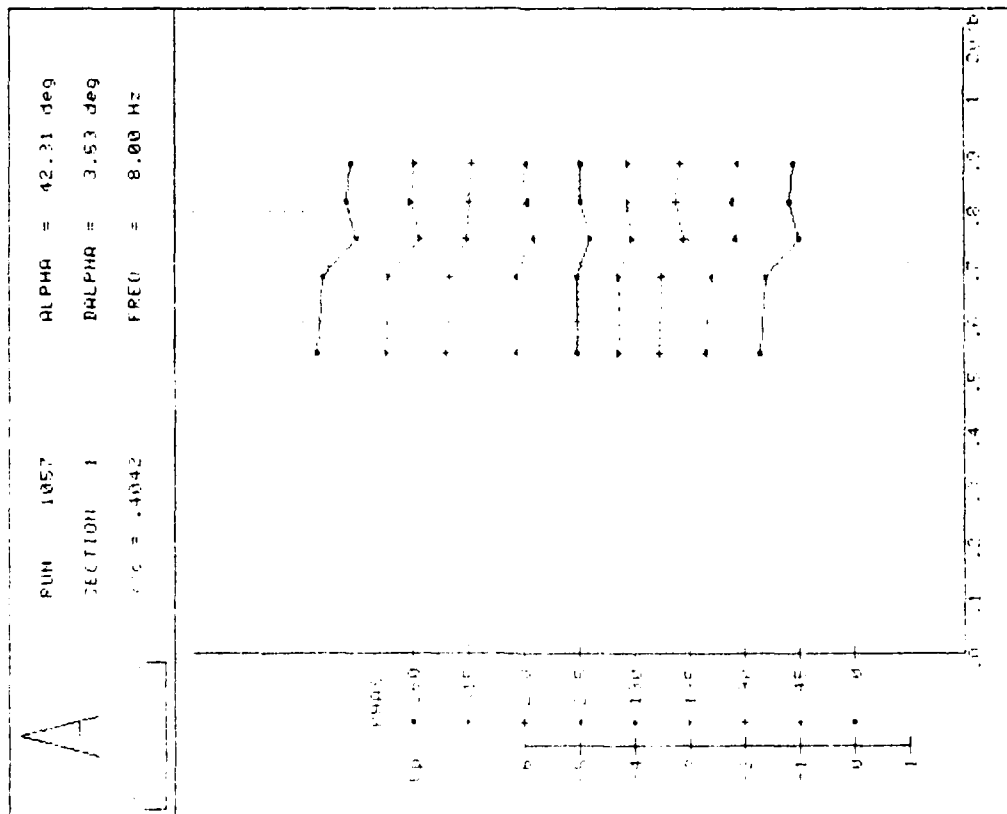
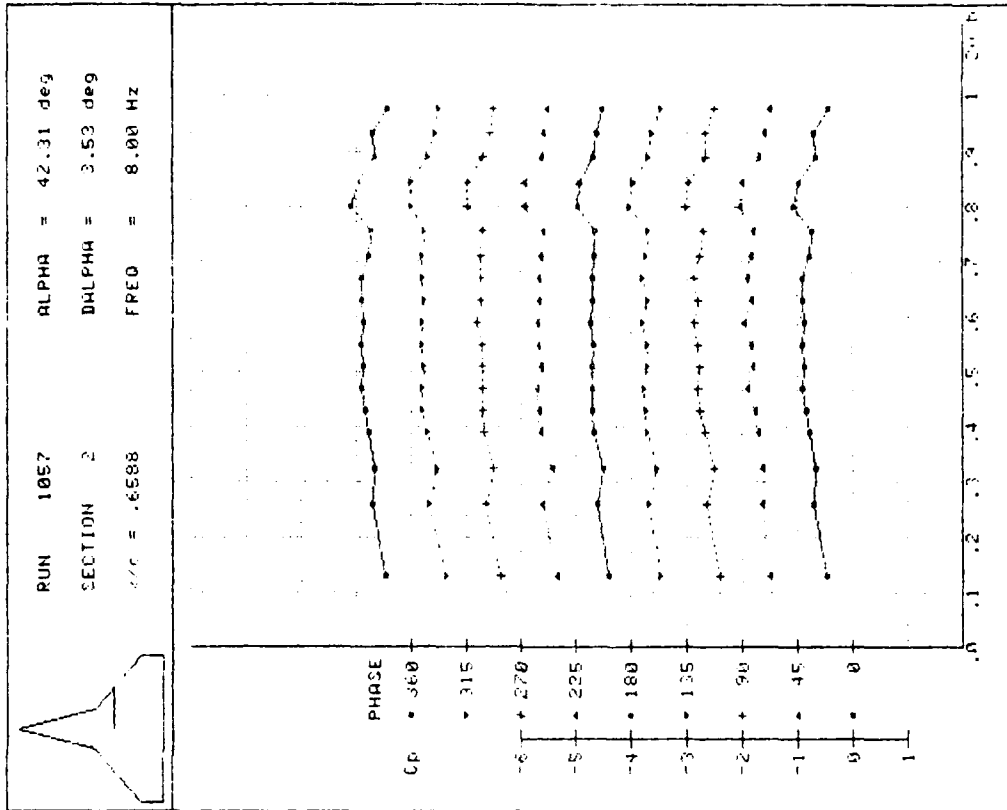


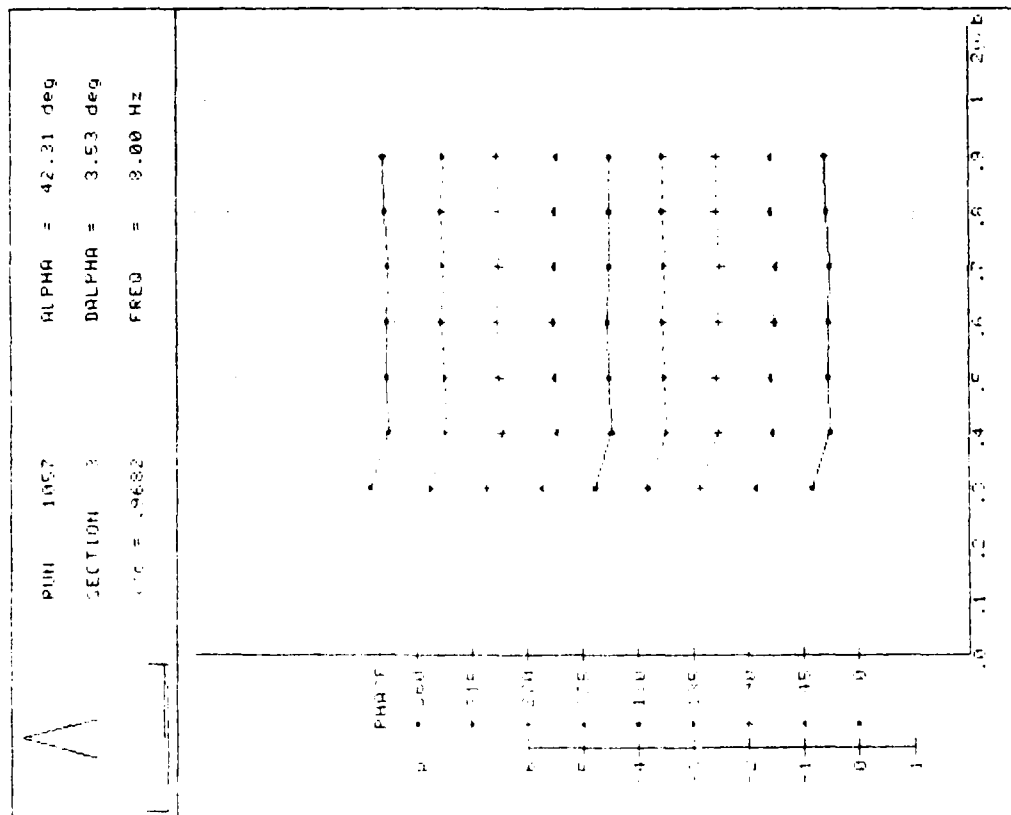
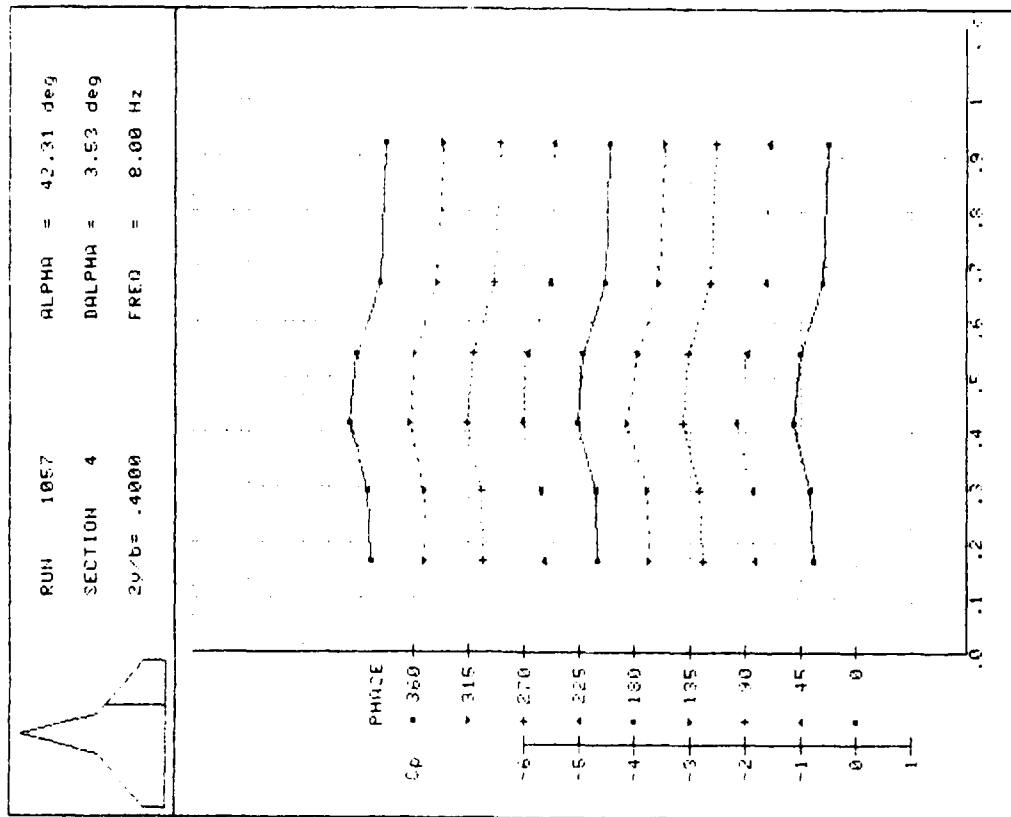


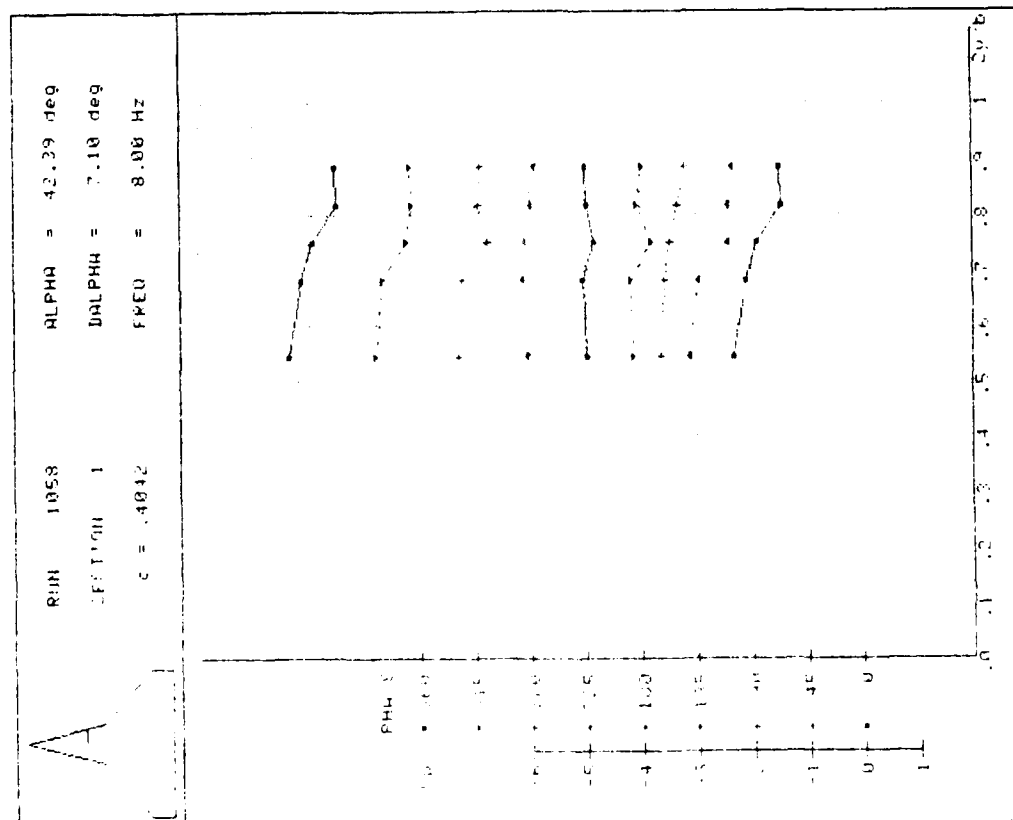
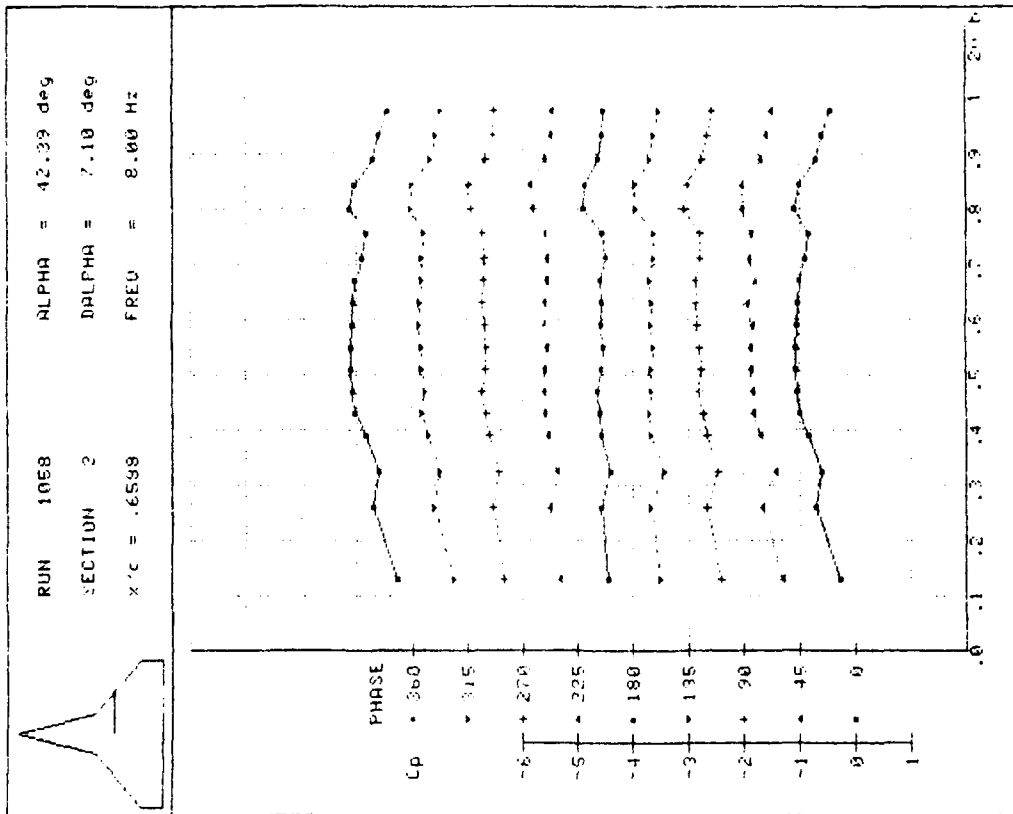


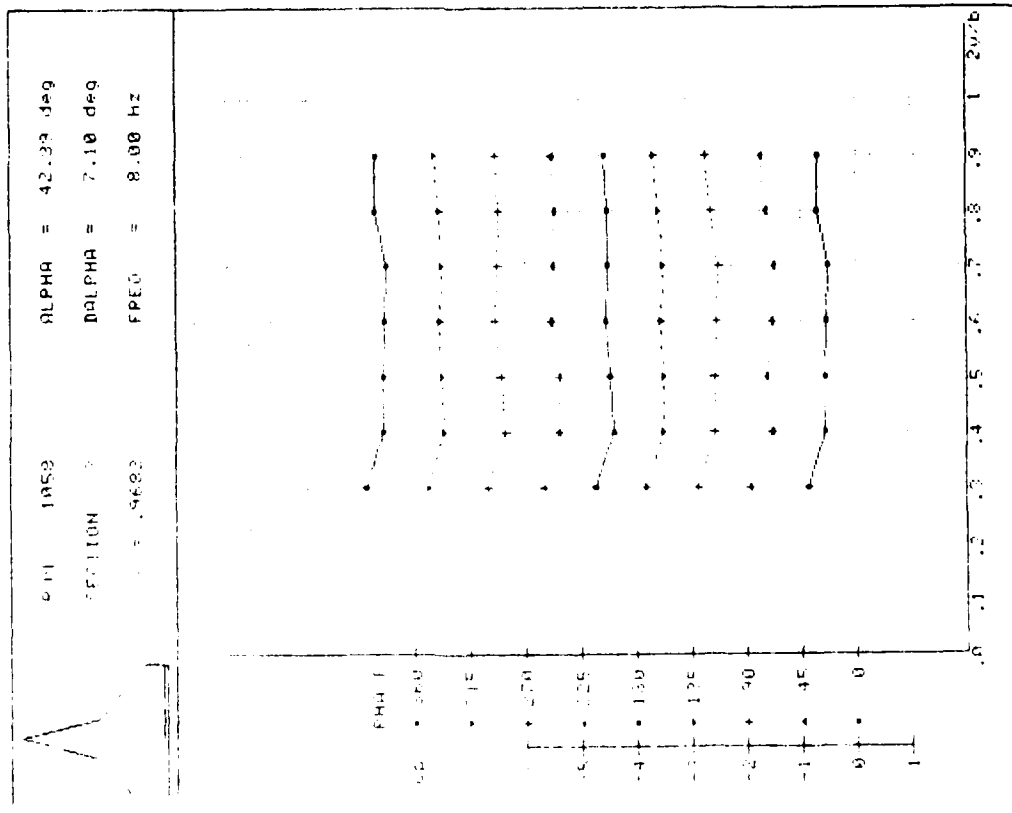
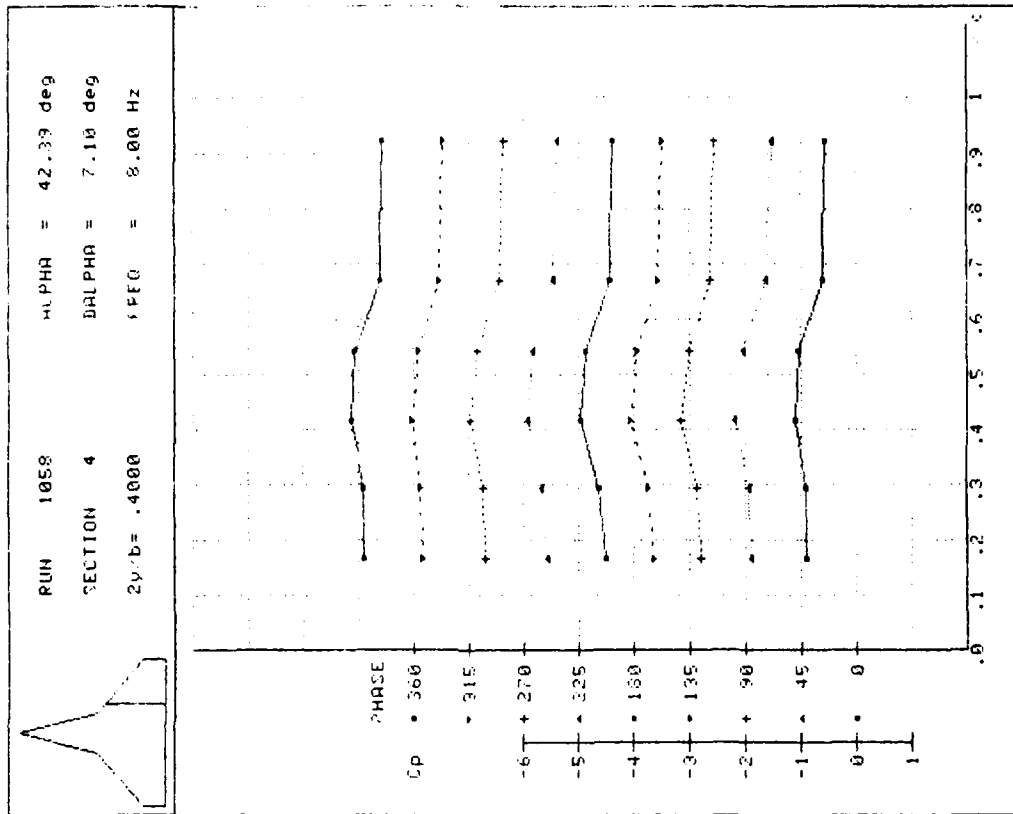


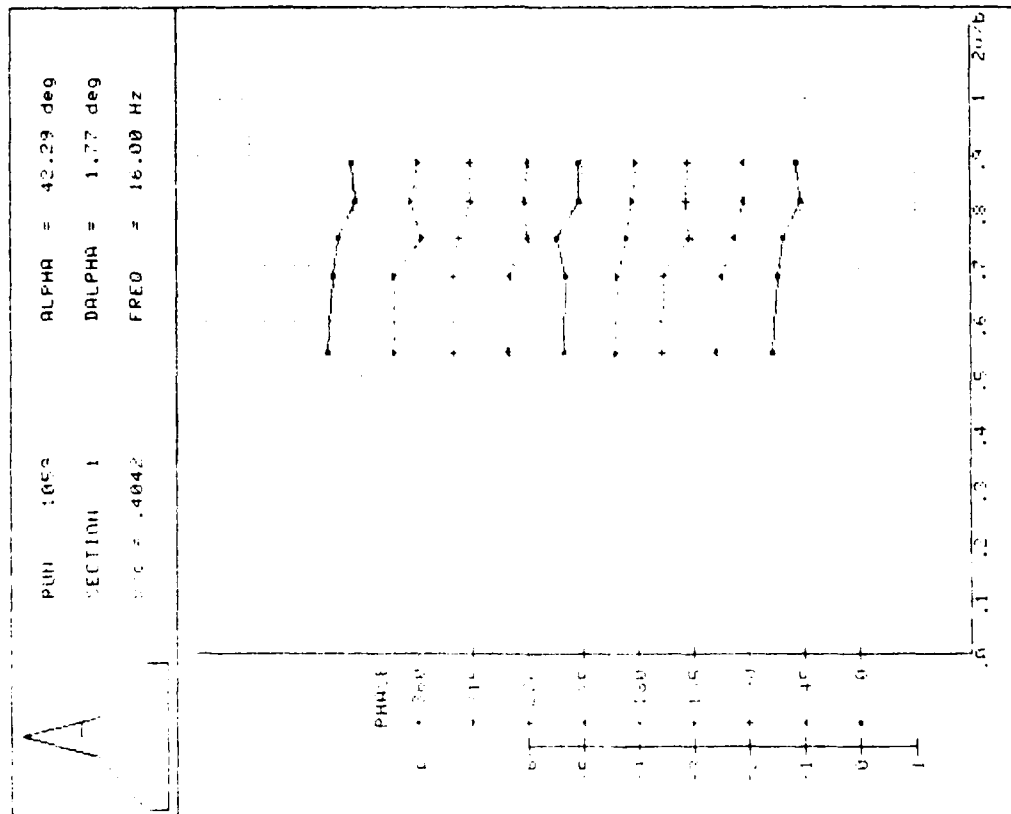
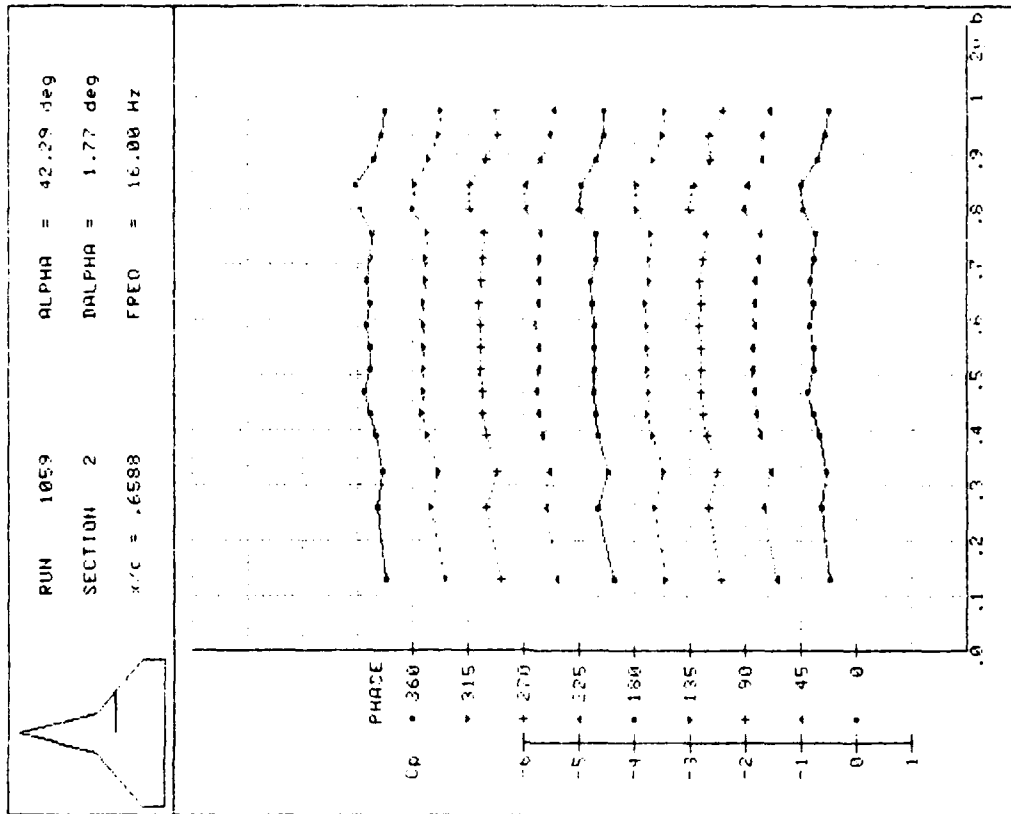


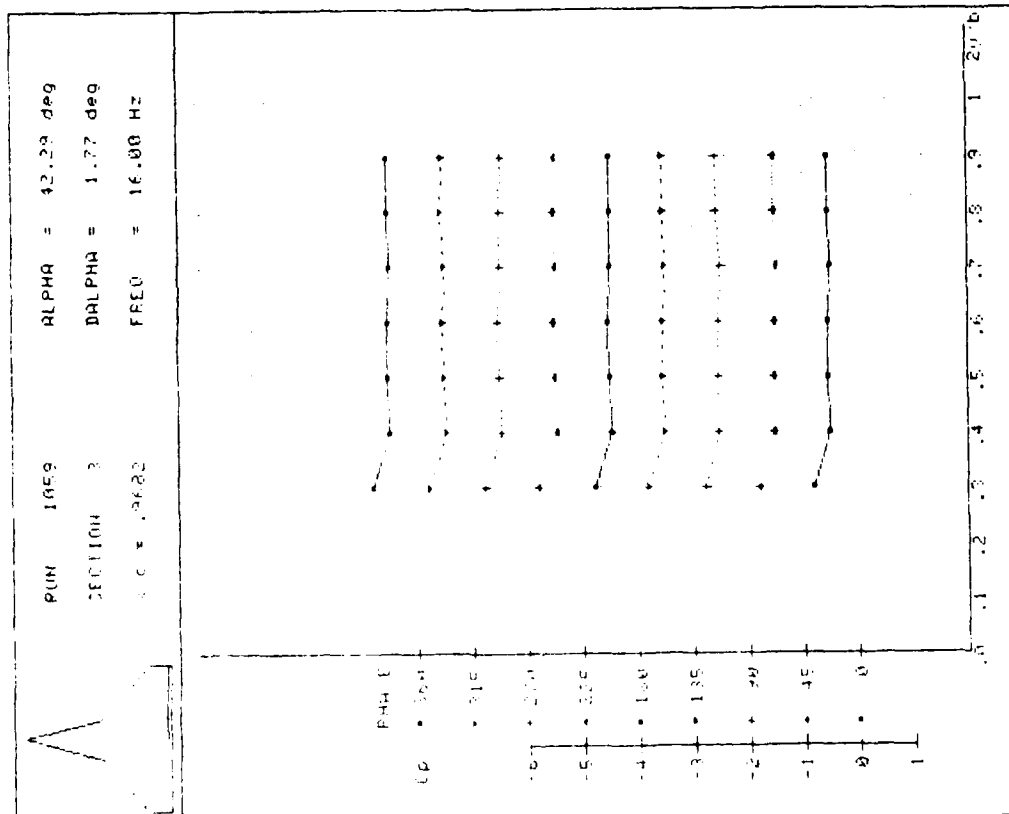
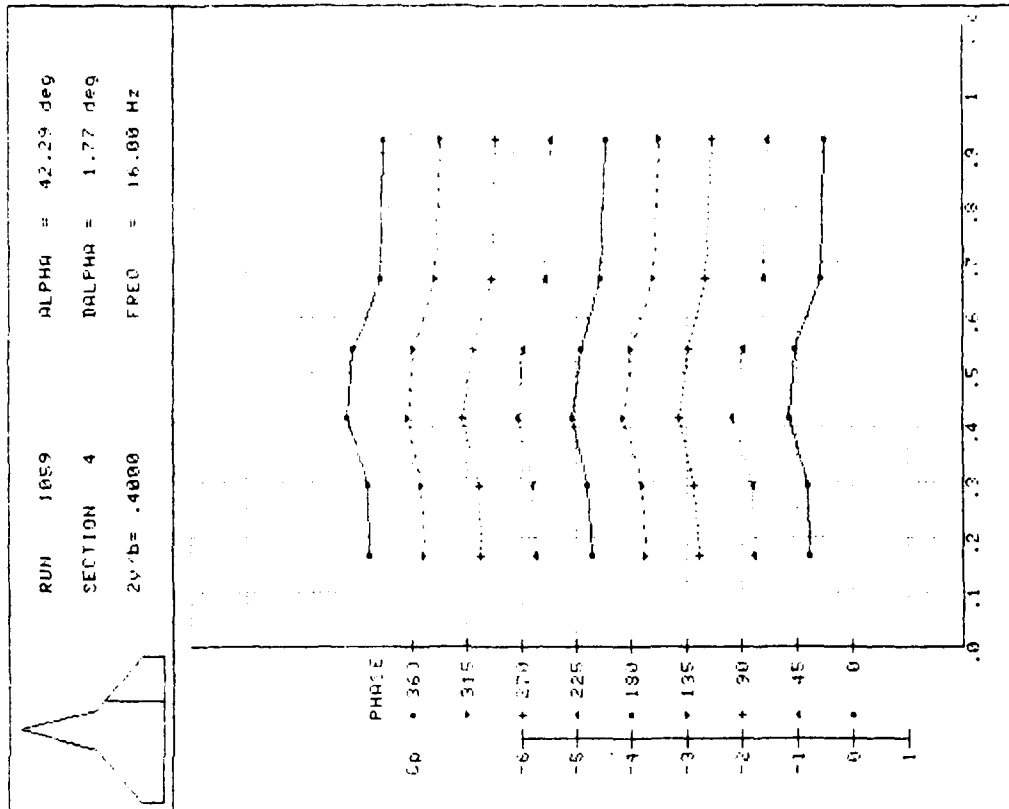




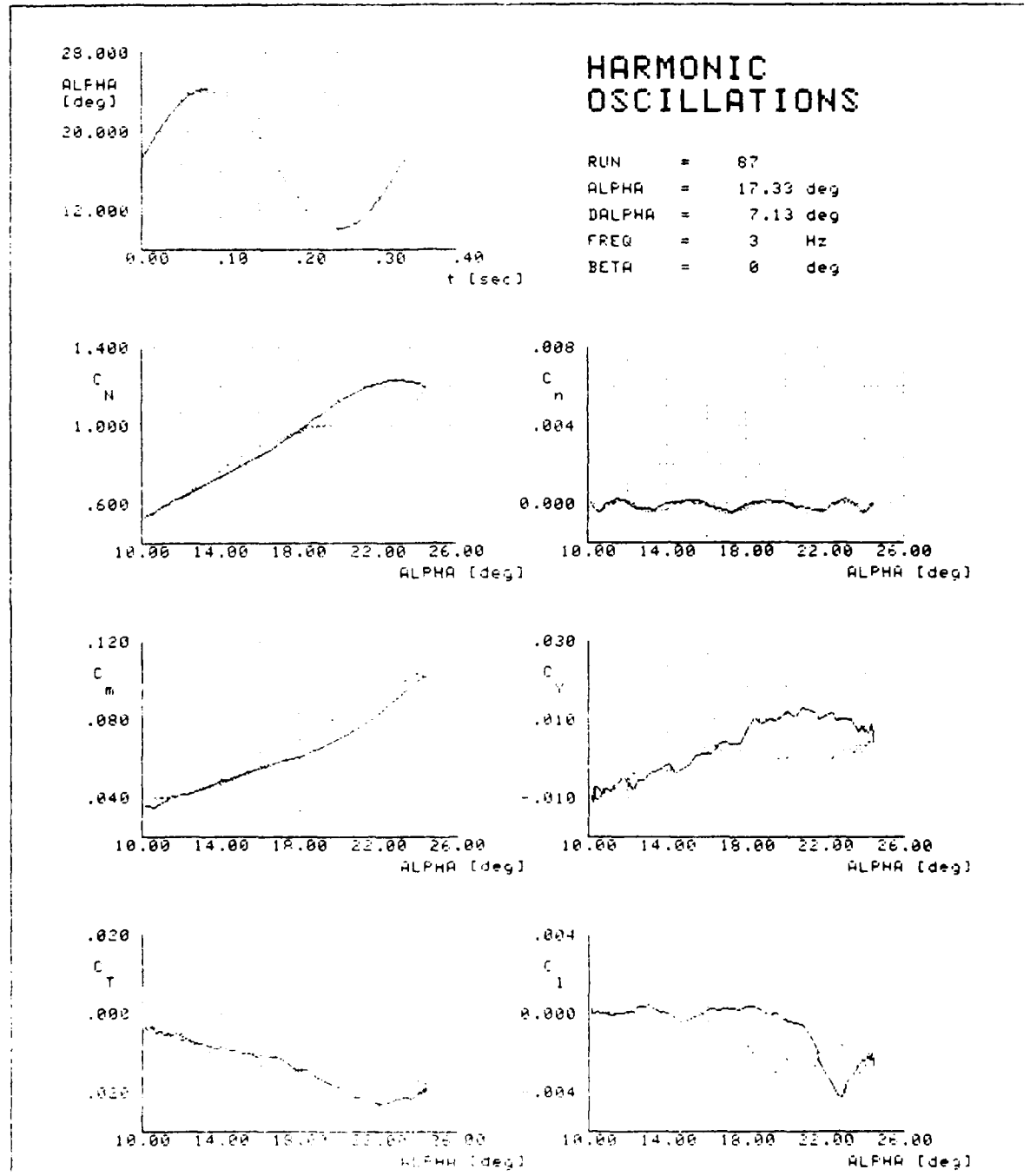




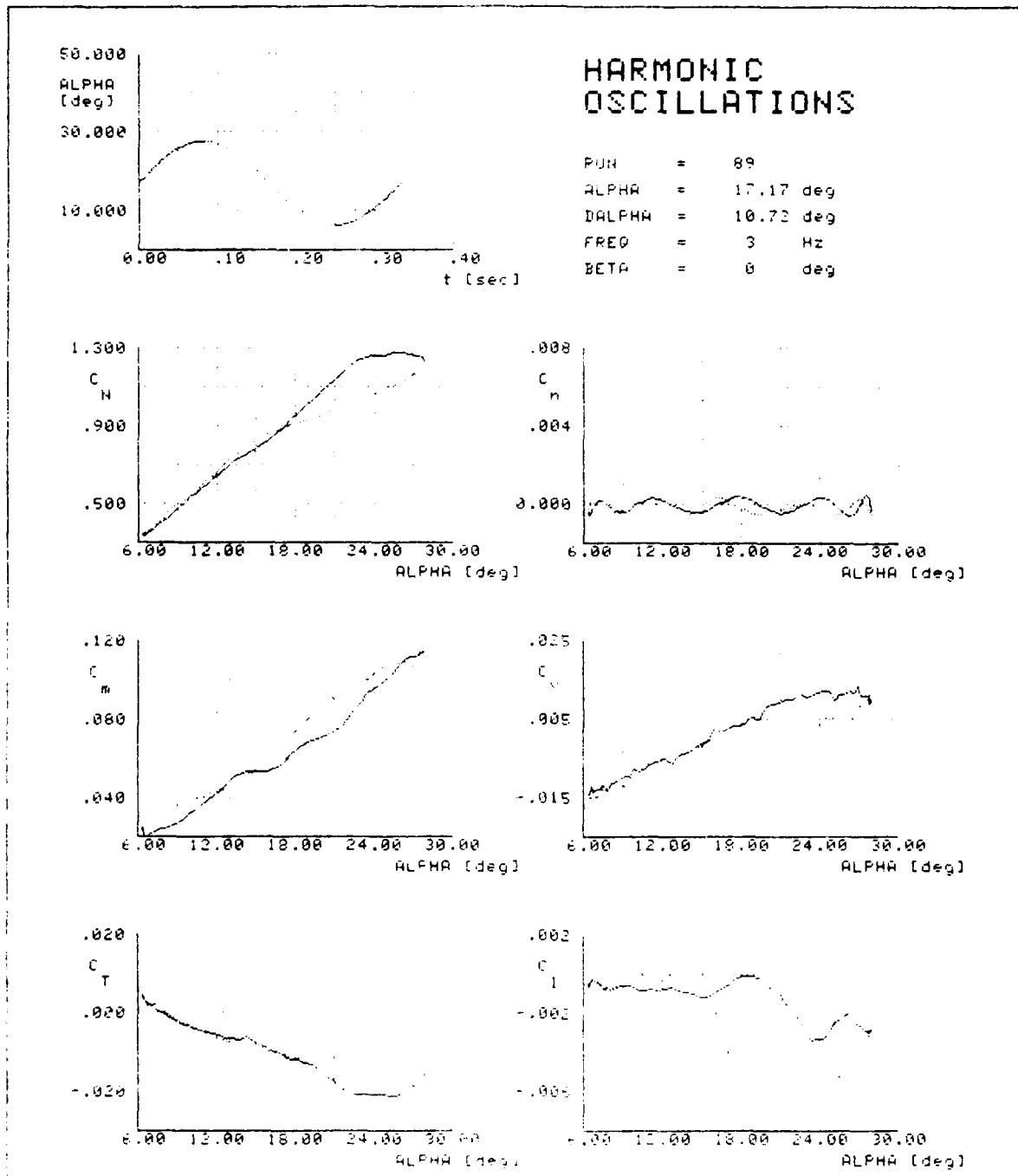


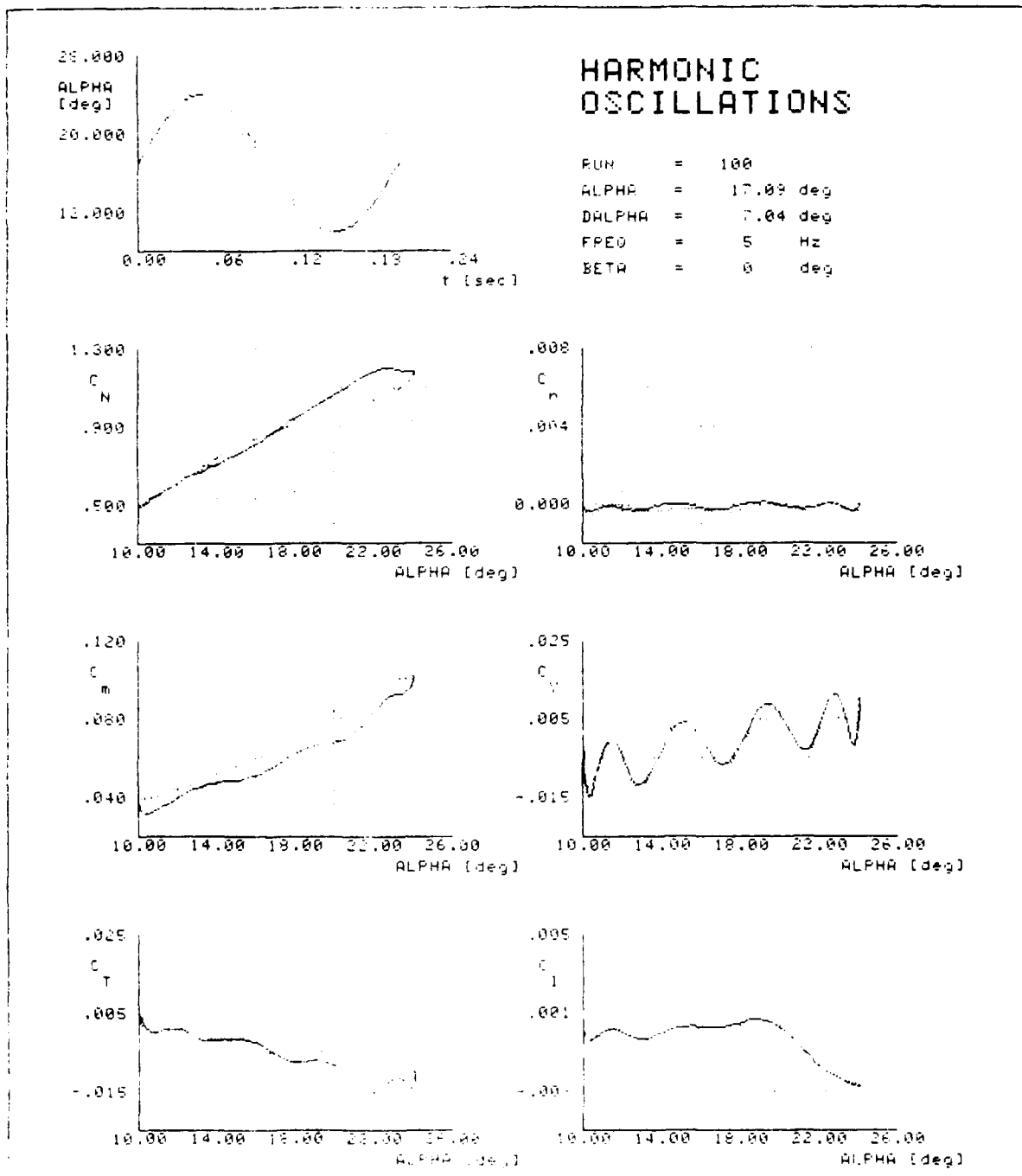


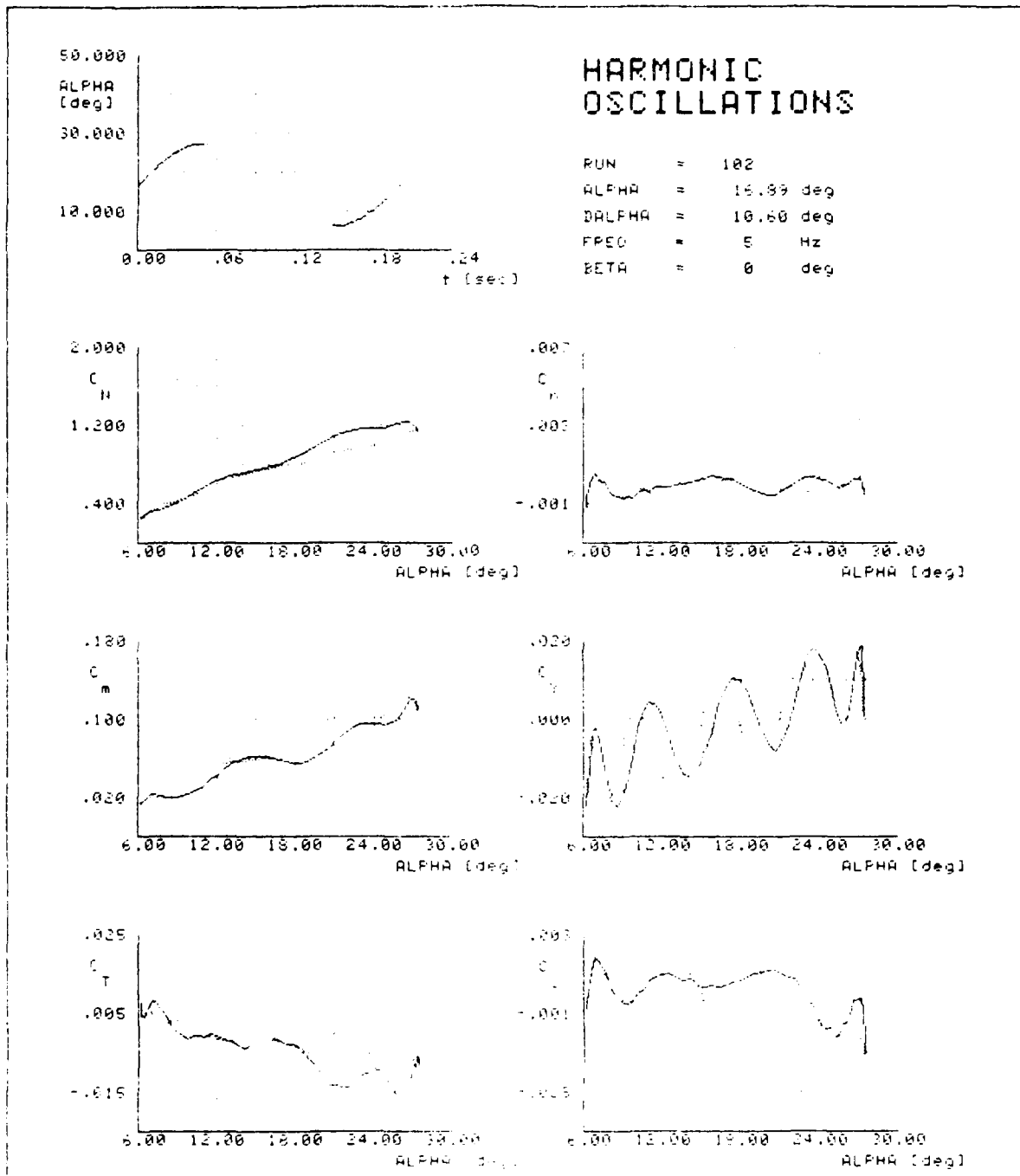
APPENDIX B  
PLOTS OF TIME HISTORIES OF OVERALL LOADS FOR  
CONTINUOUS OSCILLATING MODEL

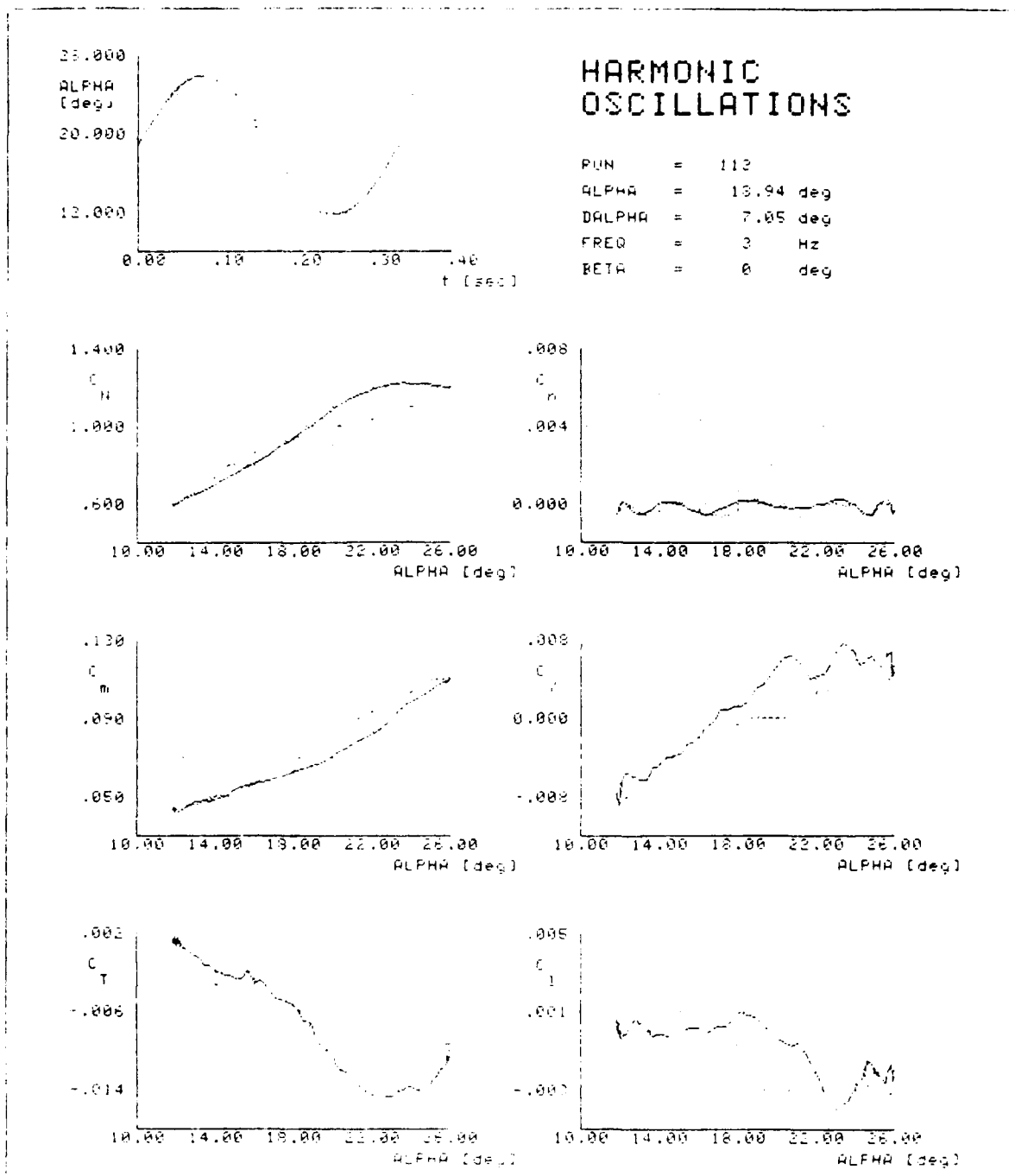


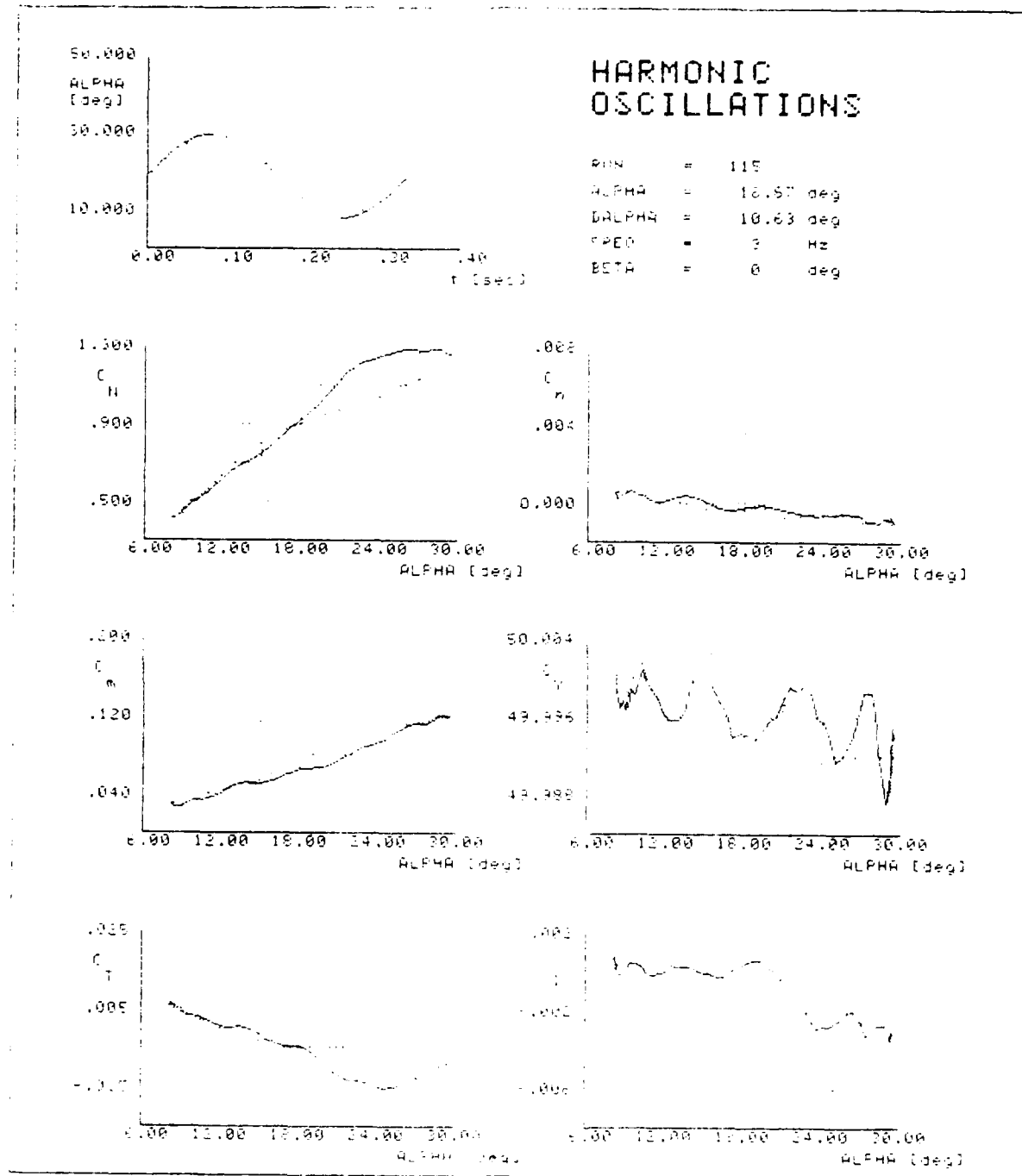


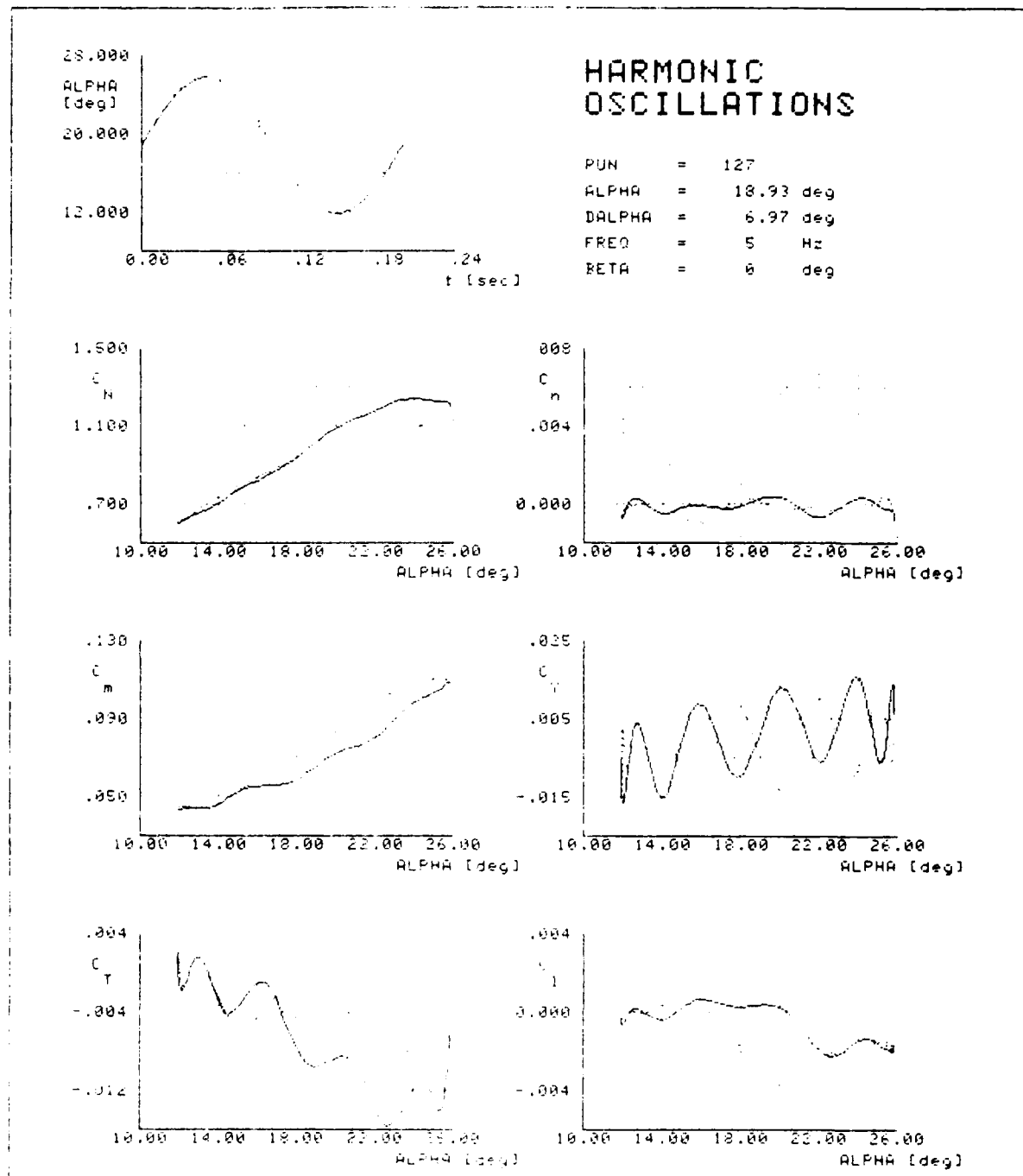


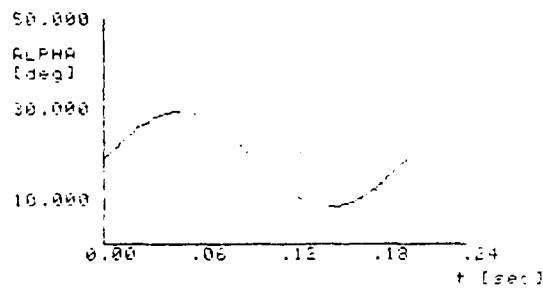






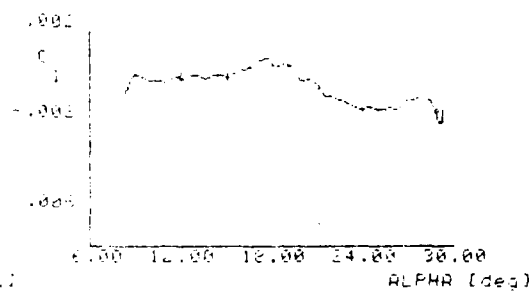
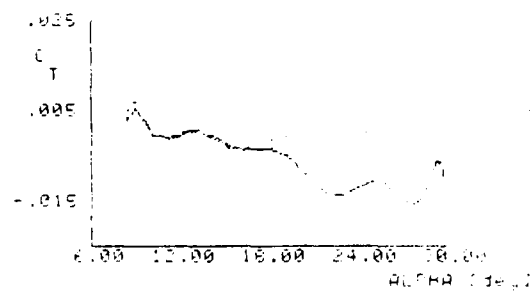
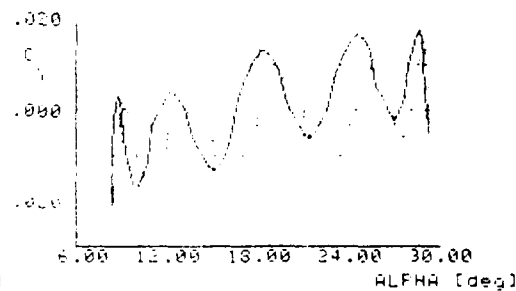
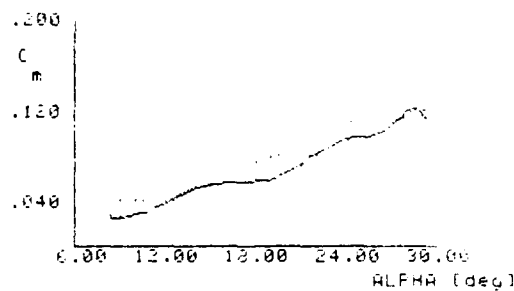
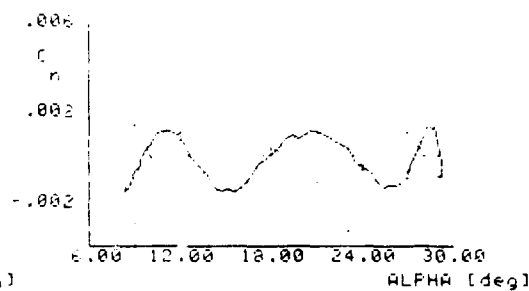
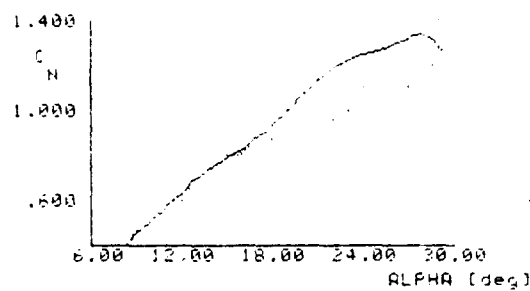


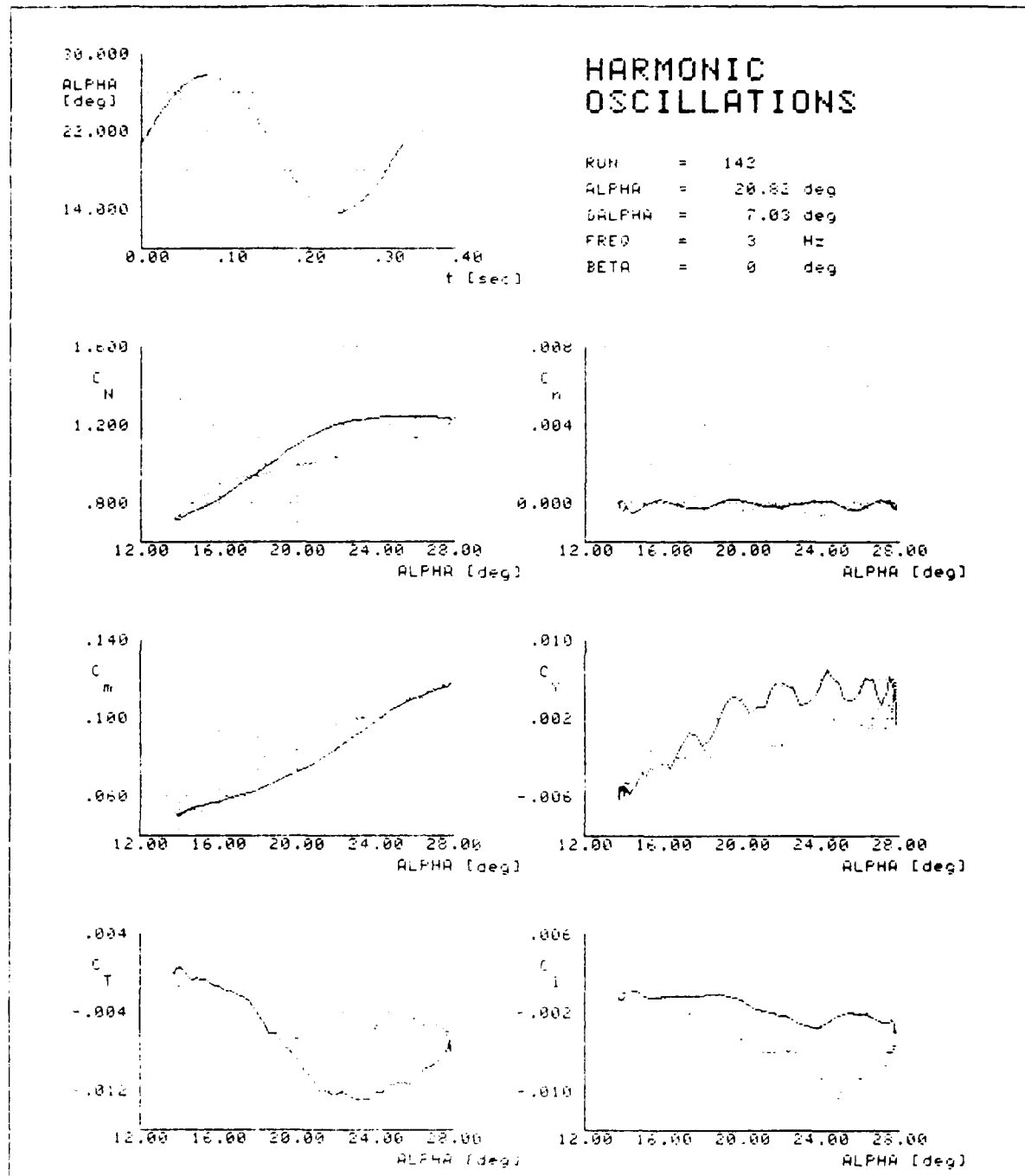




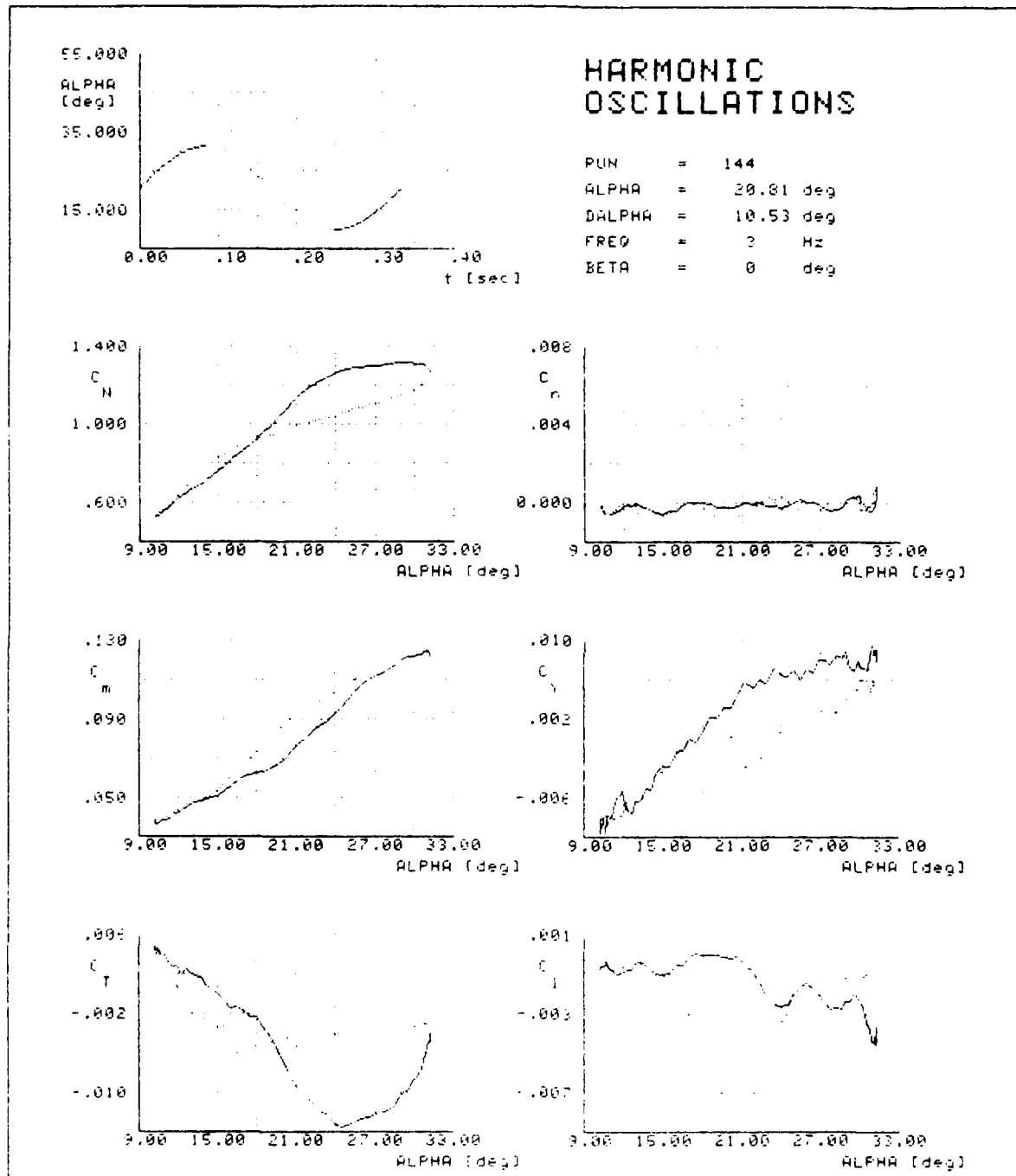
# HARMONIC OSCILLATIONS

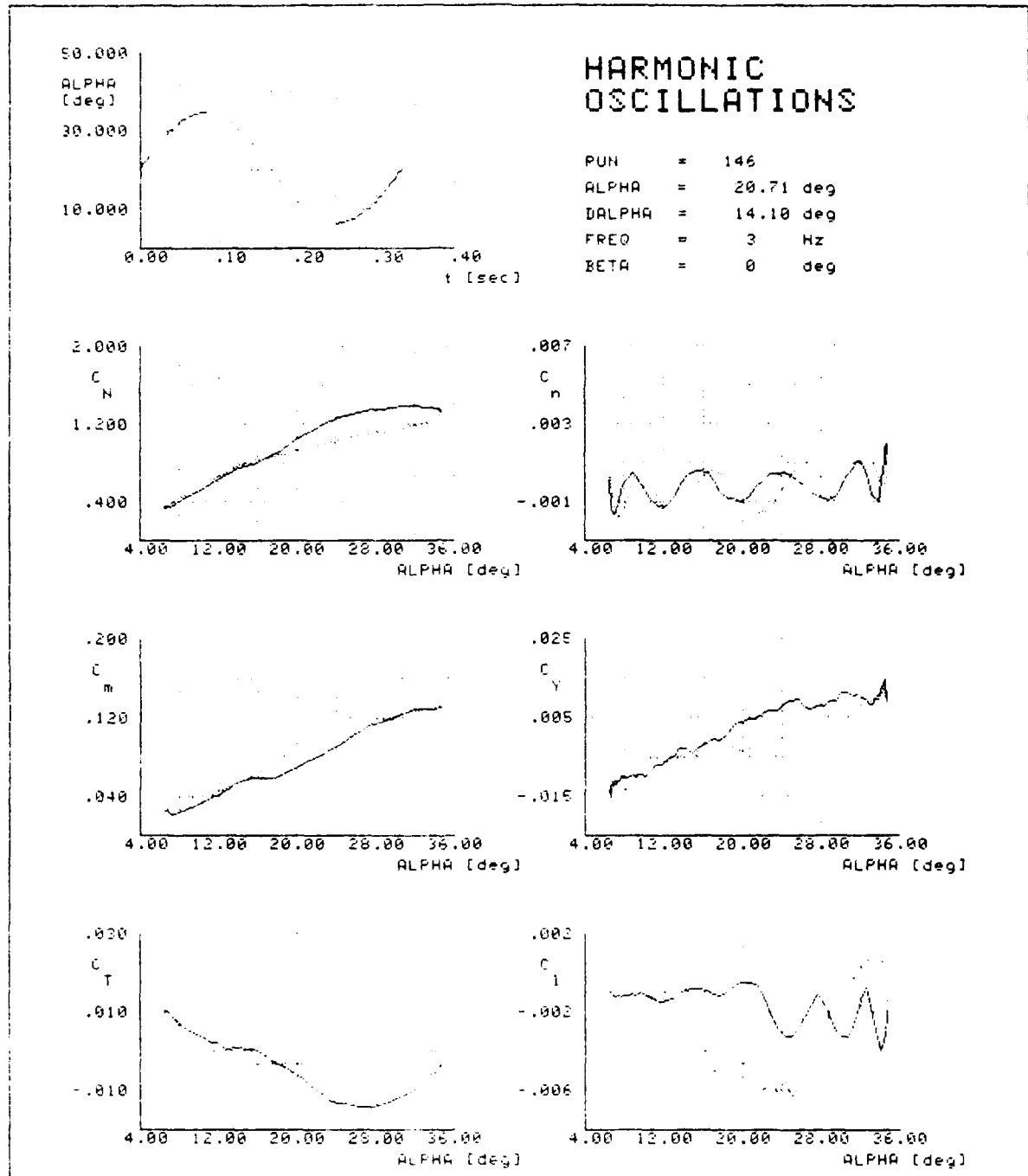
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 DIALPHA = 10.45 deg  
 FREQ = 5 Hz  
 BETA = 0 deg

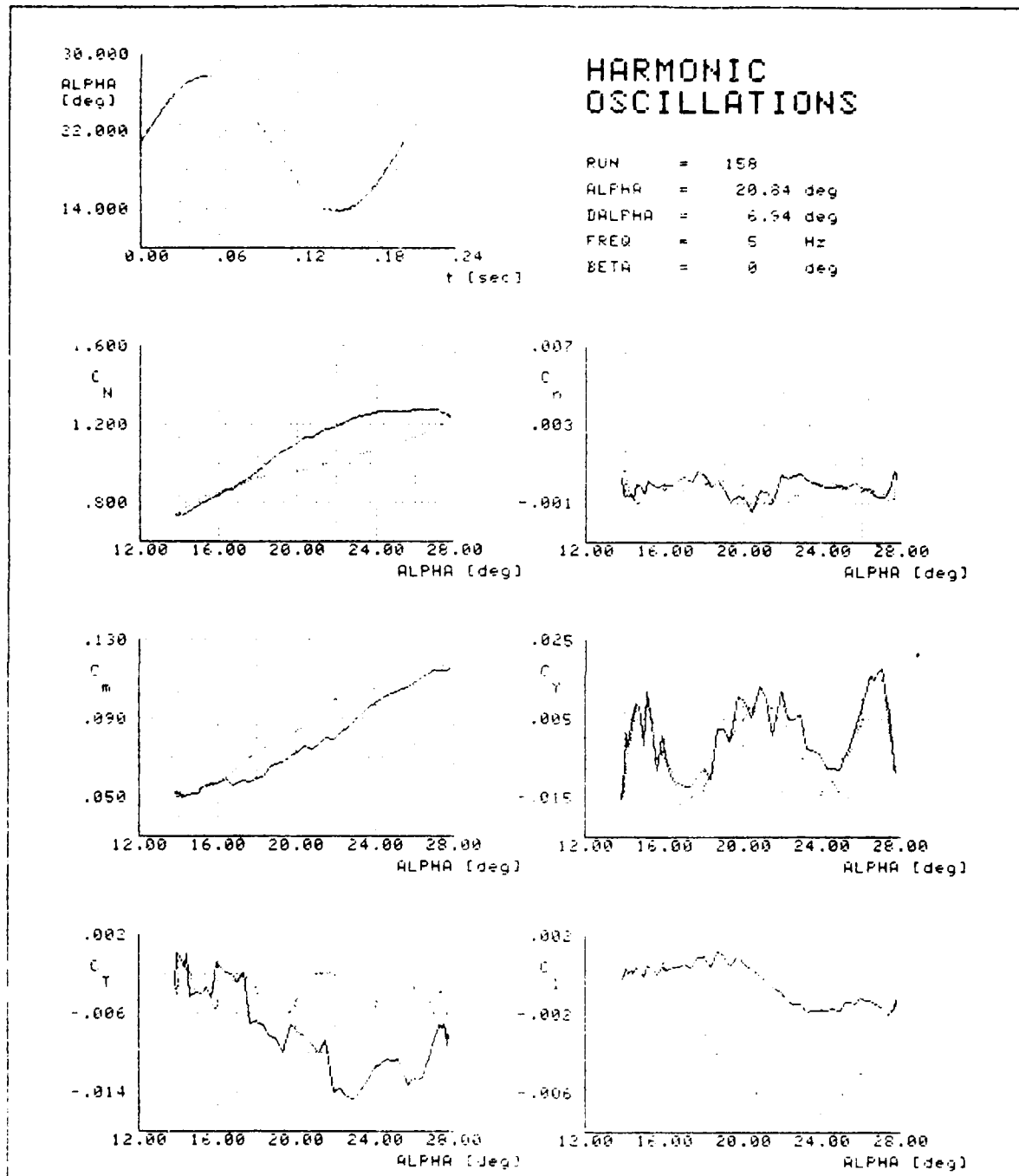


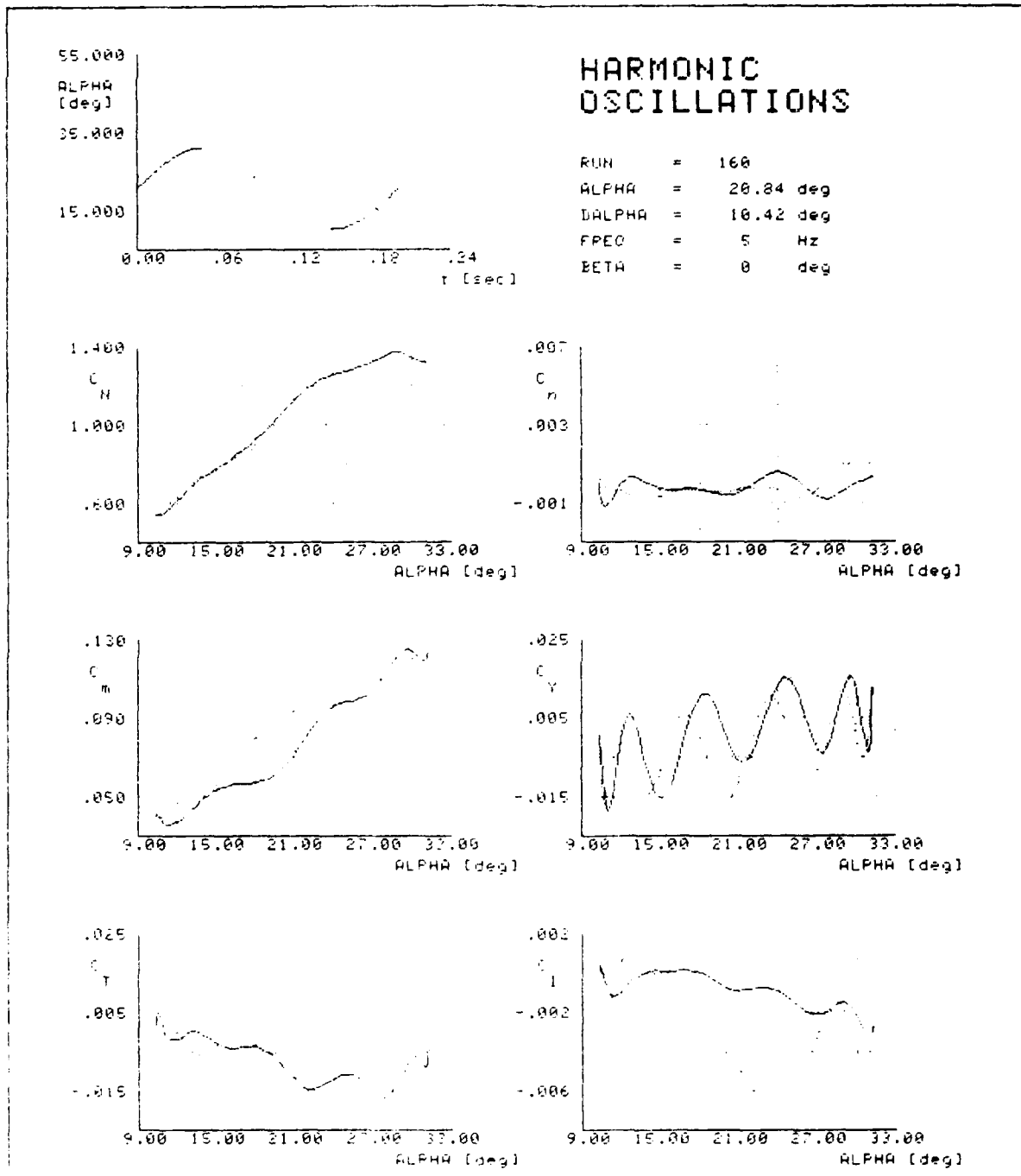


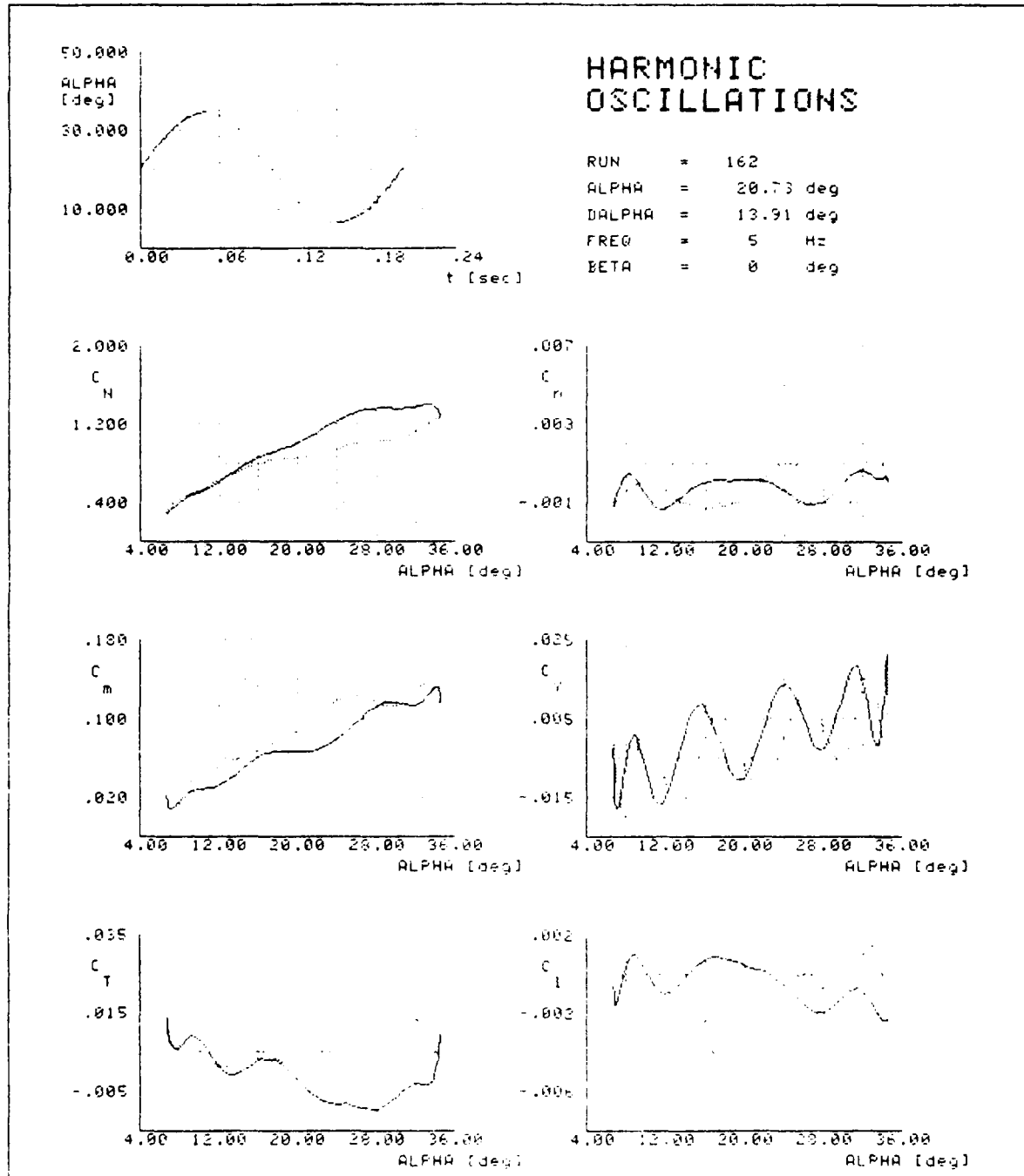


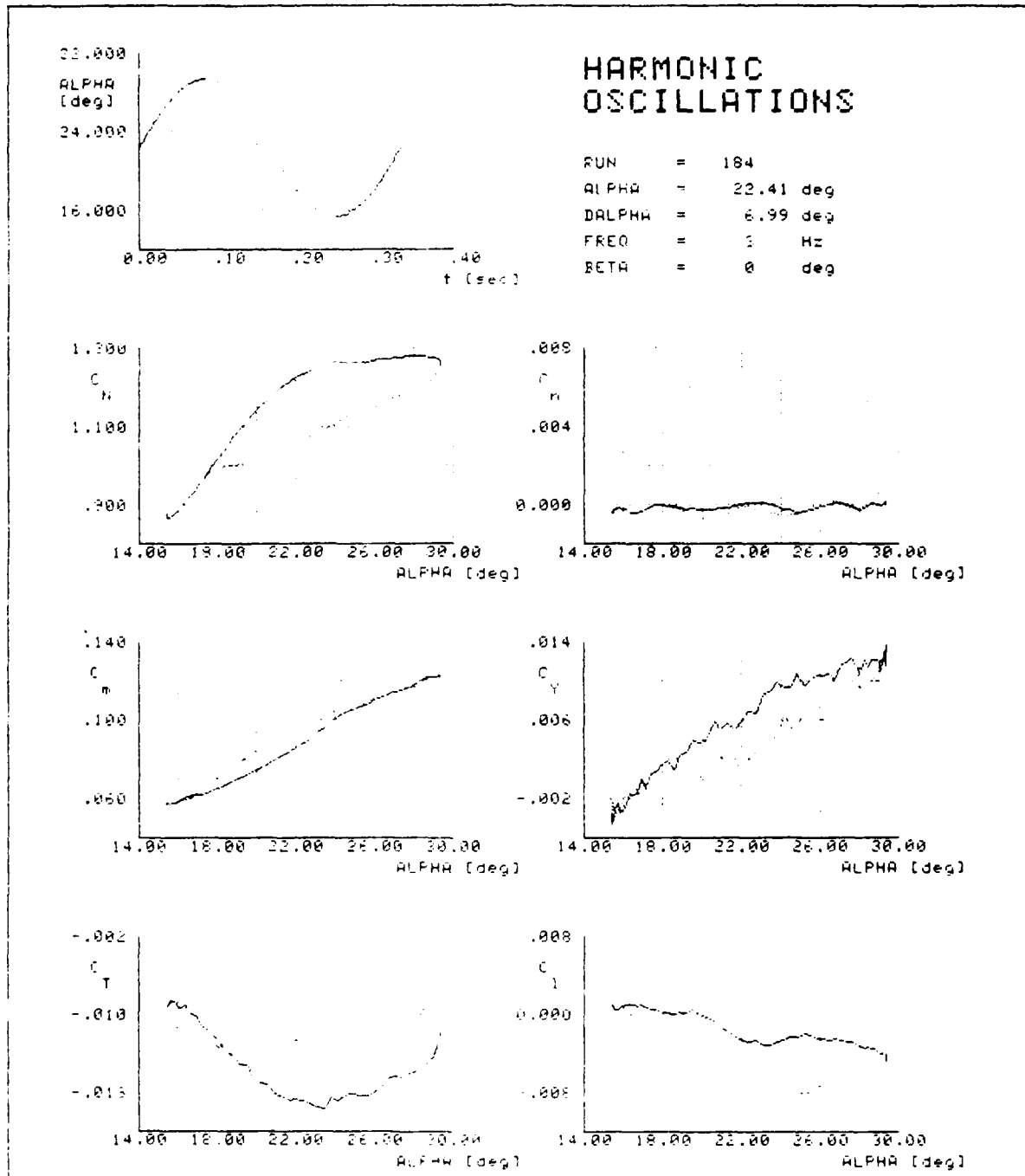


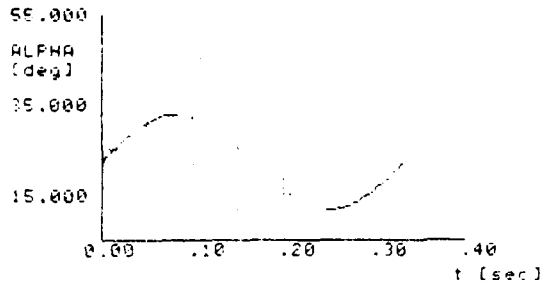






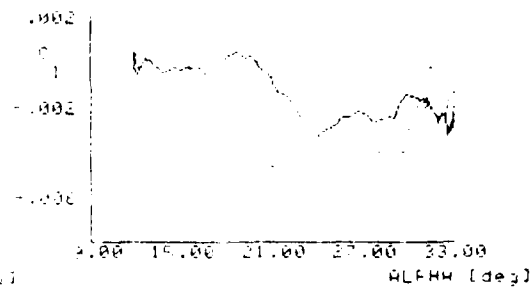
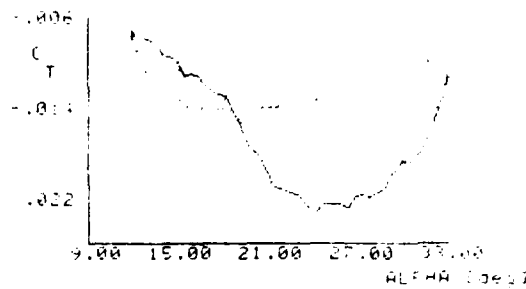
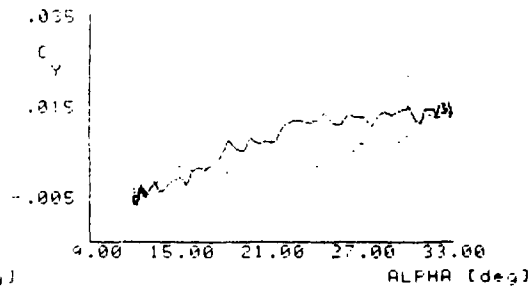
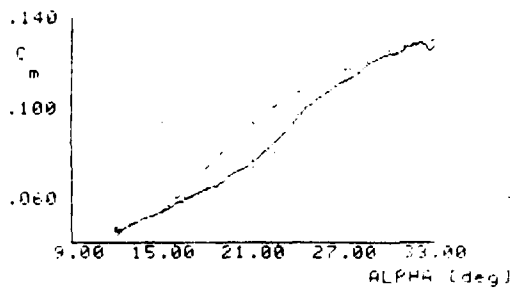
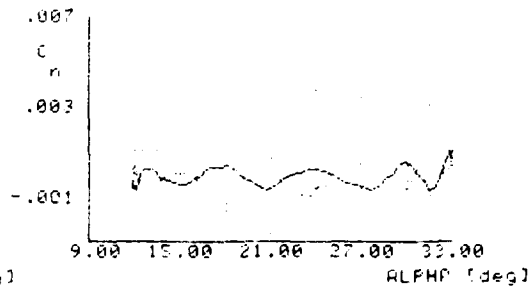
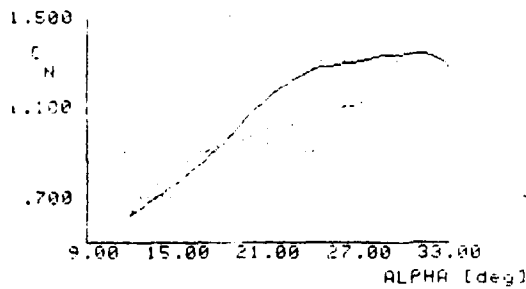


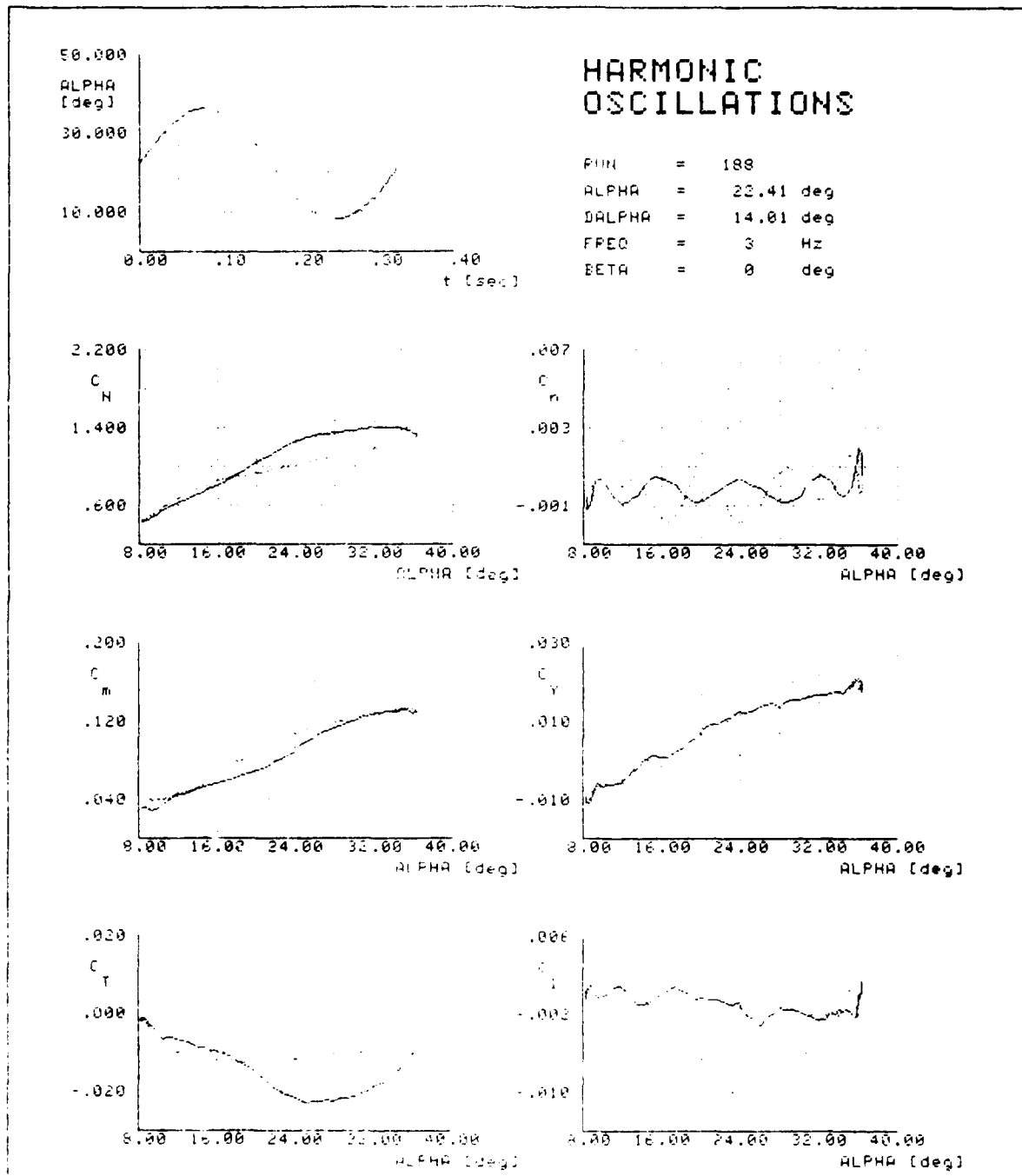




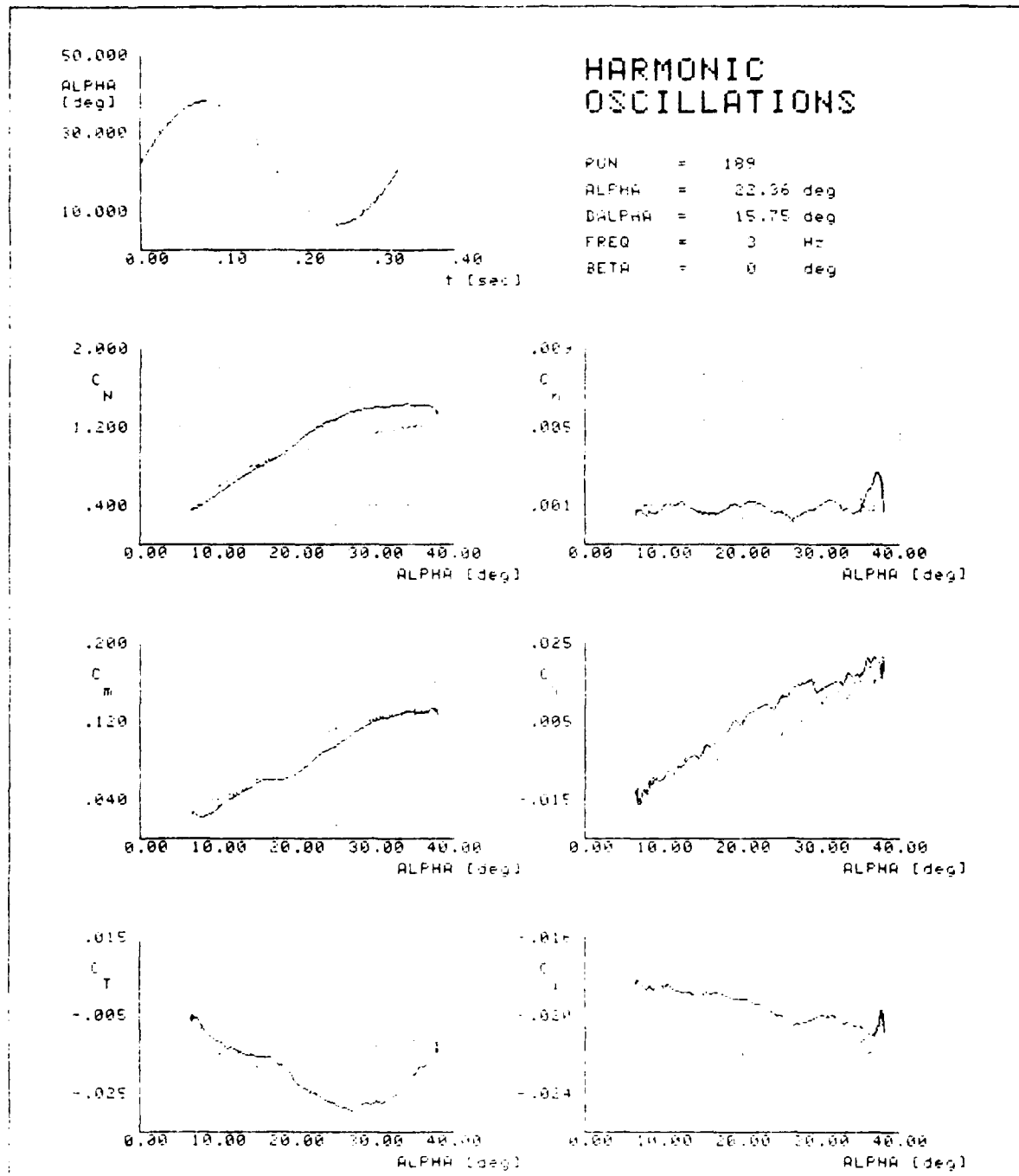
# HARMONIC OSCILLATIONS

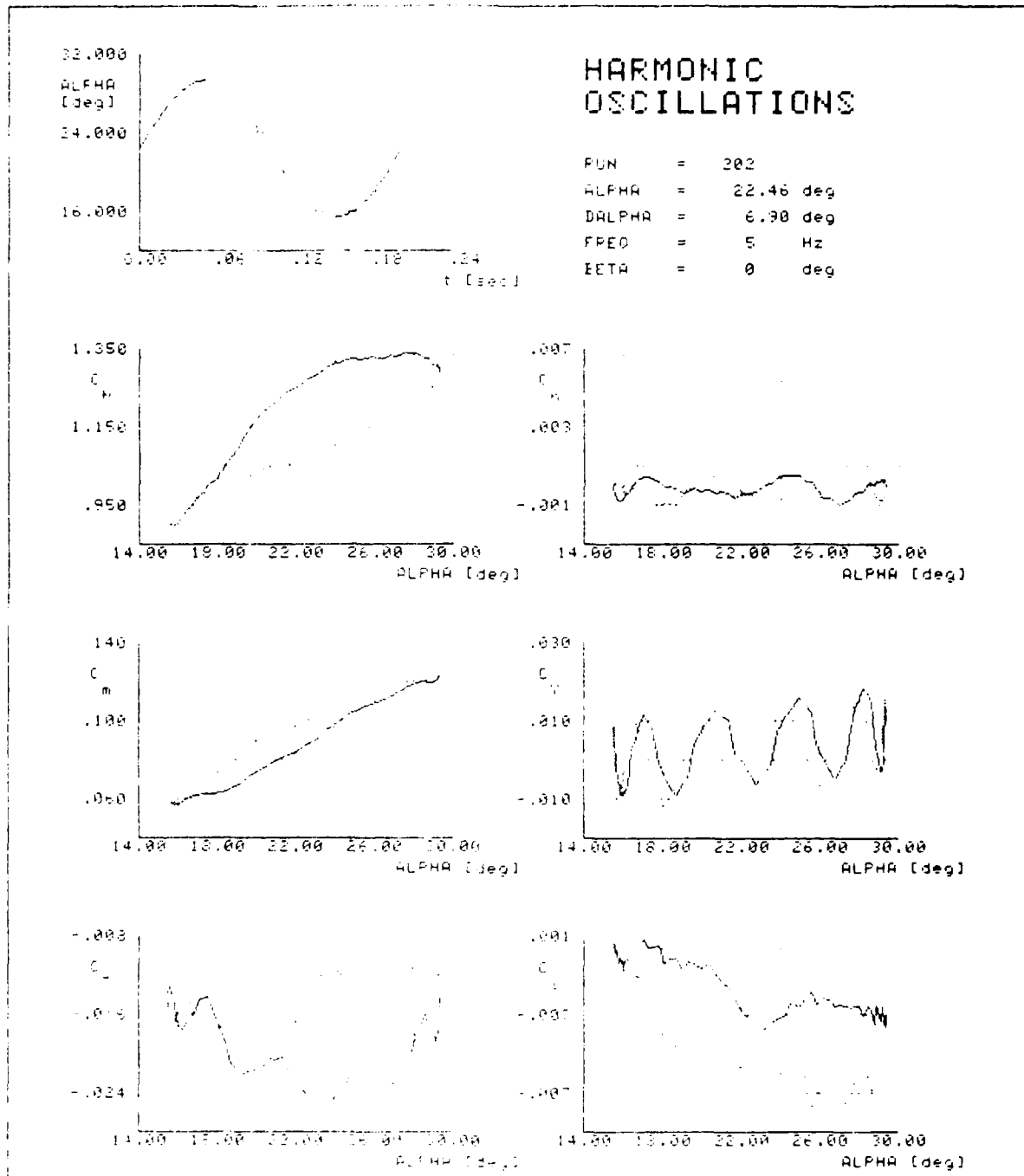
RUN = 196  
ALPHA = 22.42 deg  
DALPHA = 10.48 deg  
FREQ = 3 Hz  
BETA = 0 deg

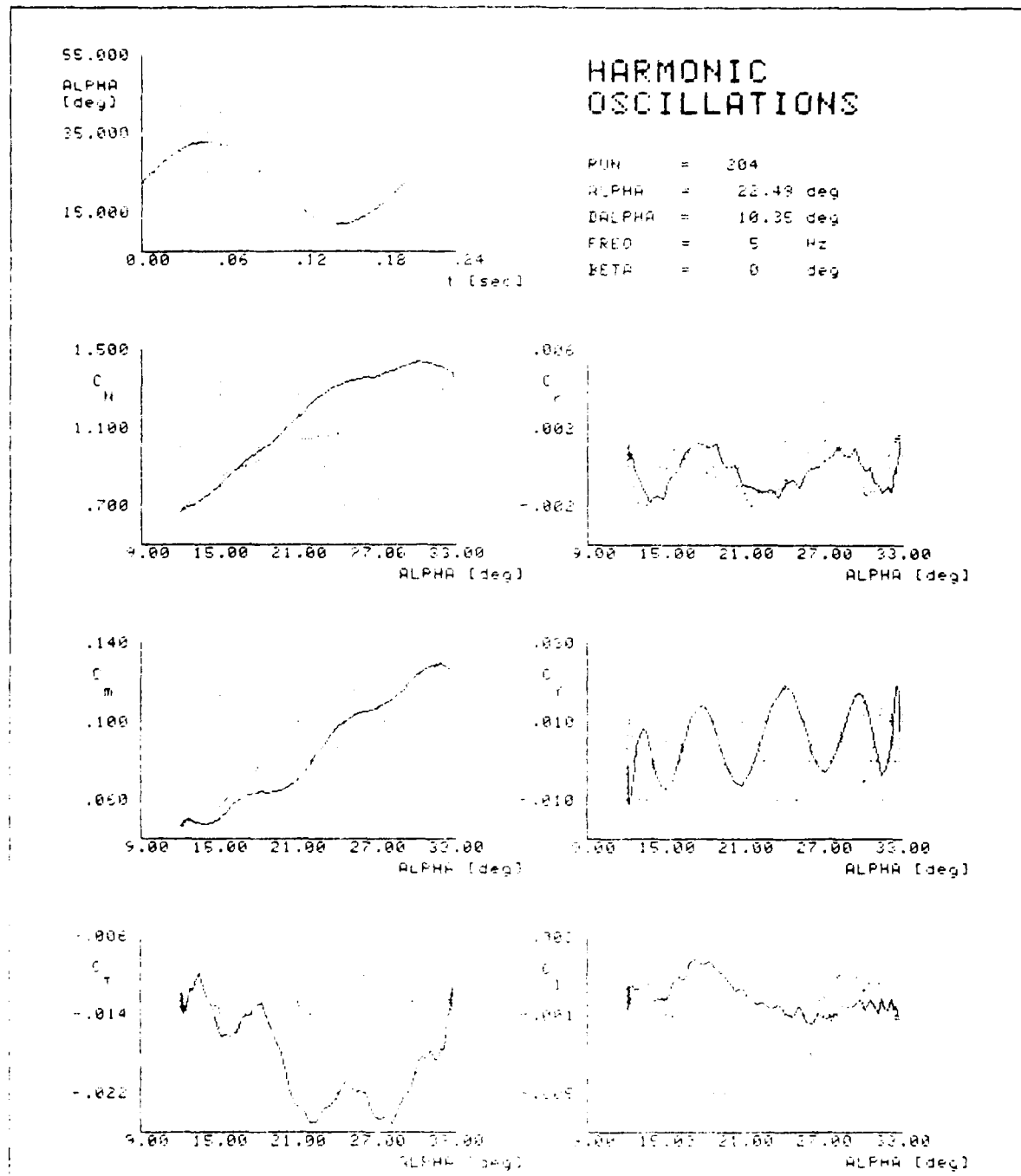


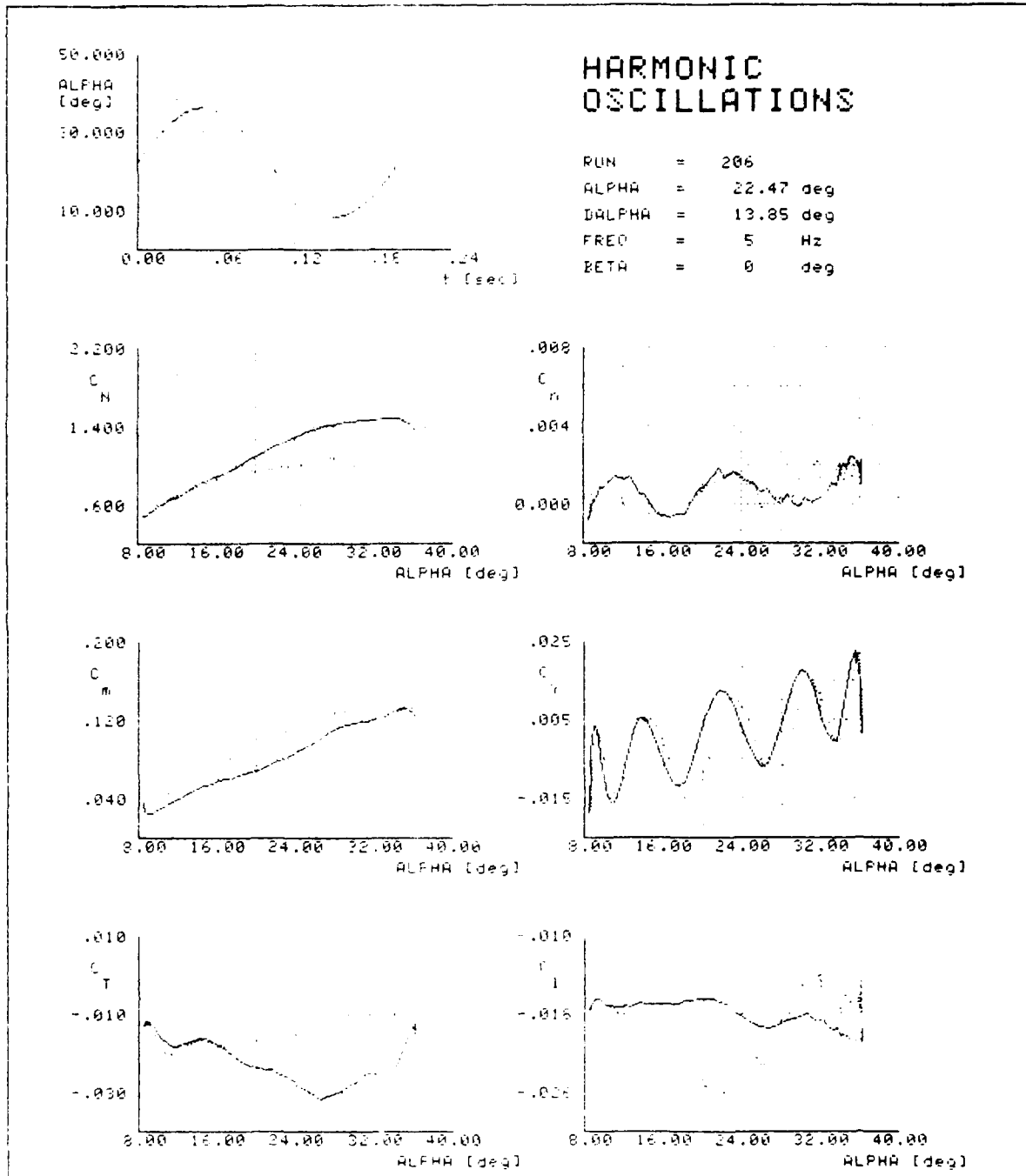


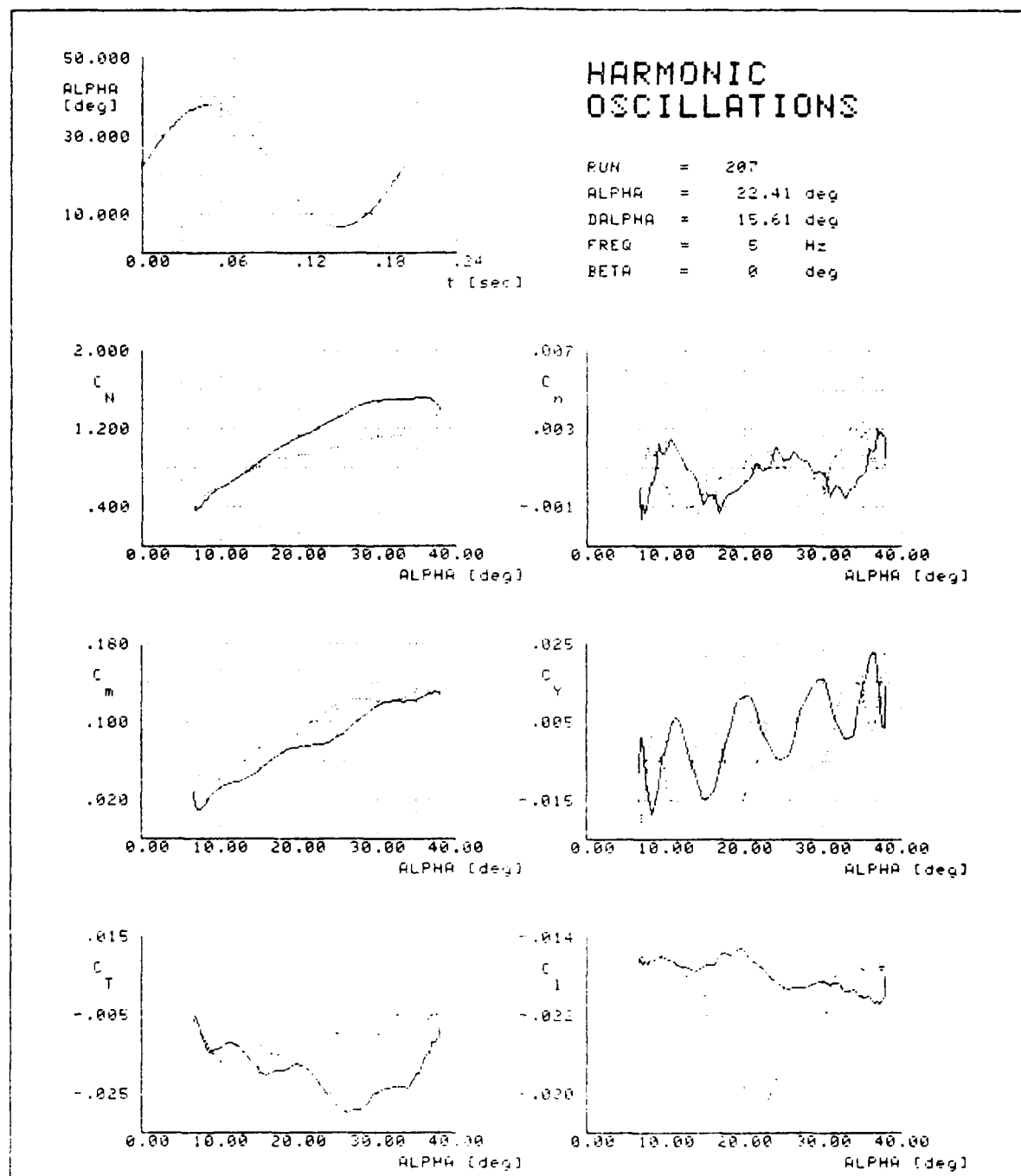


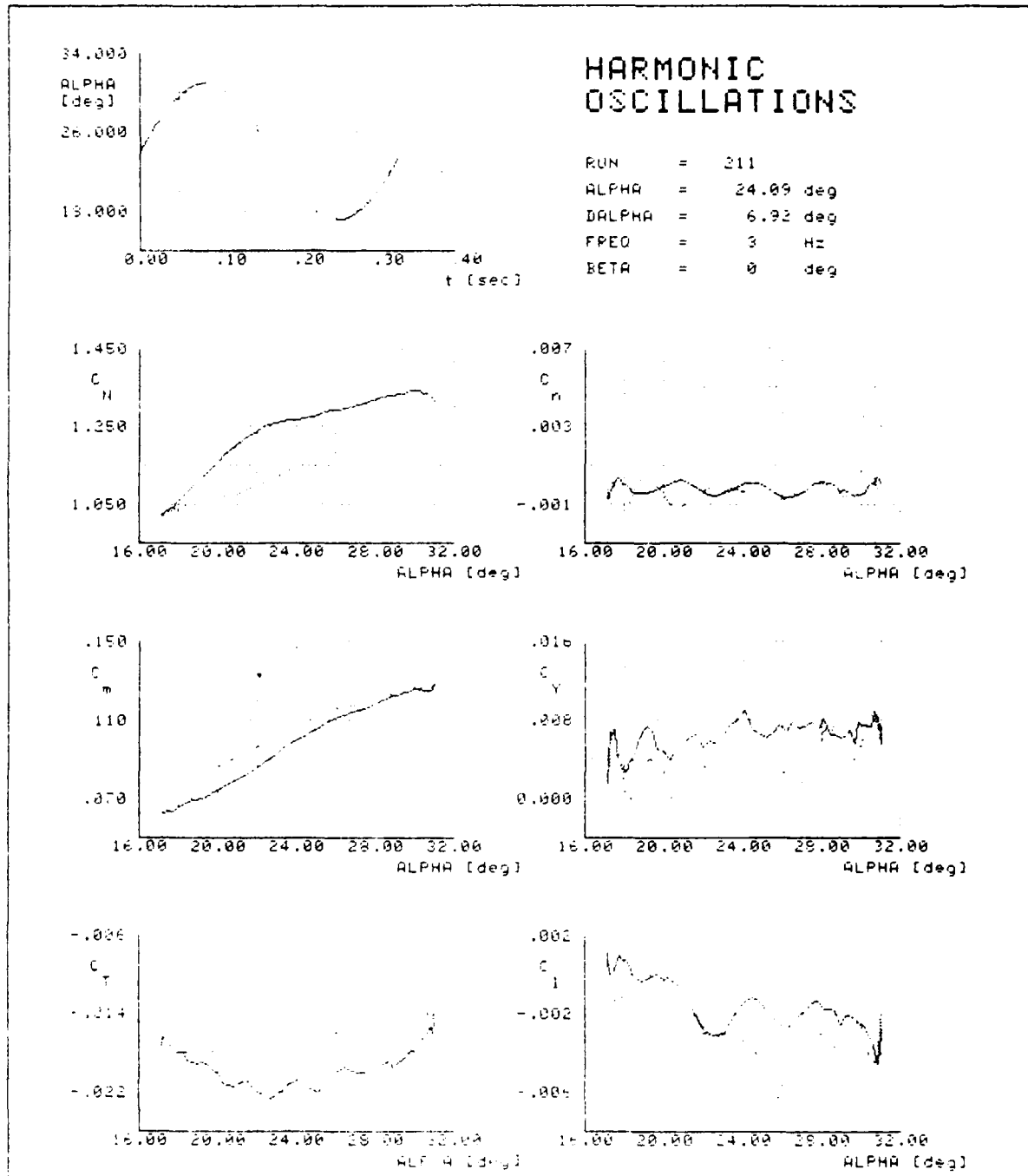


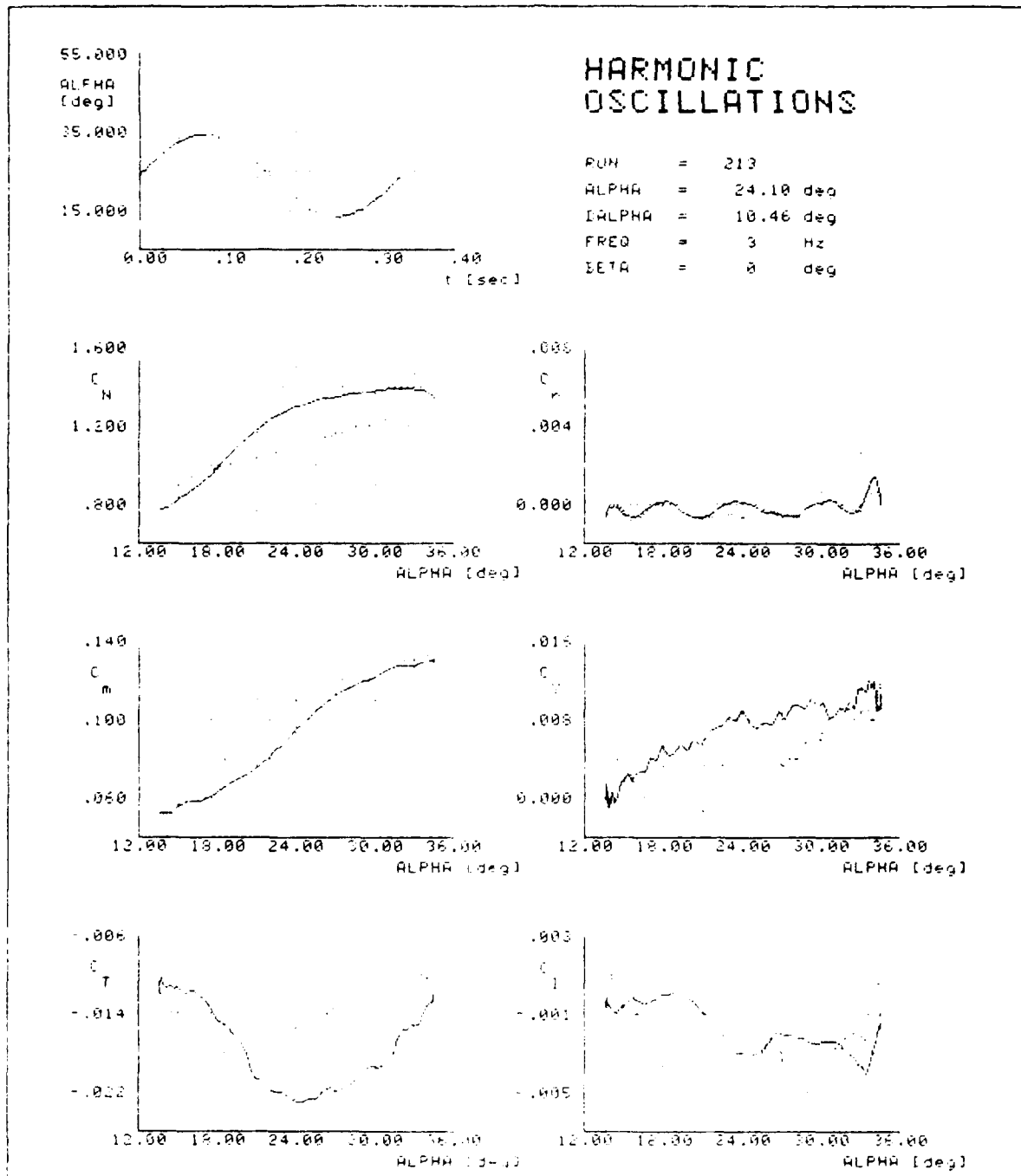


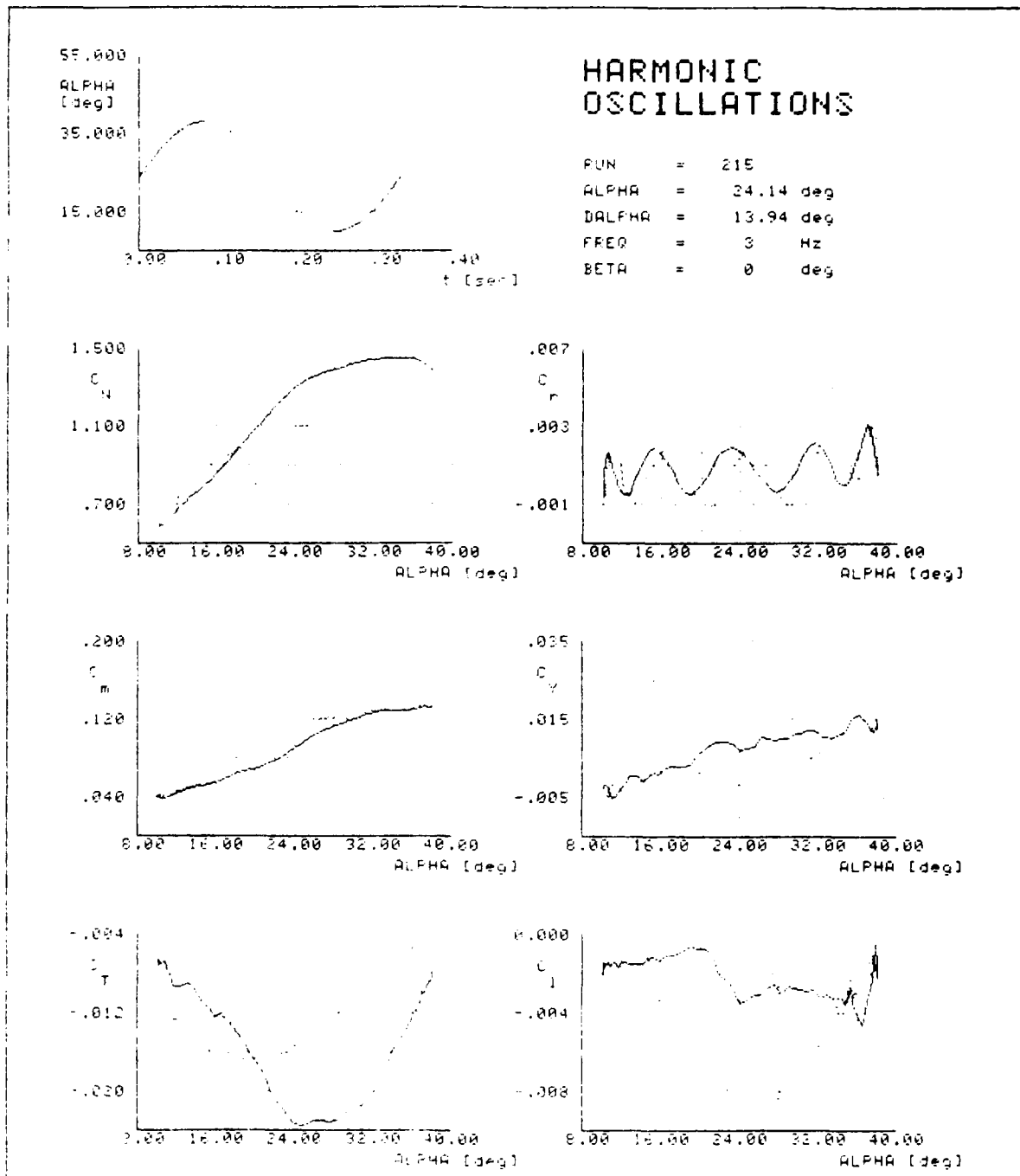




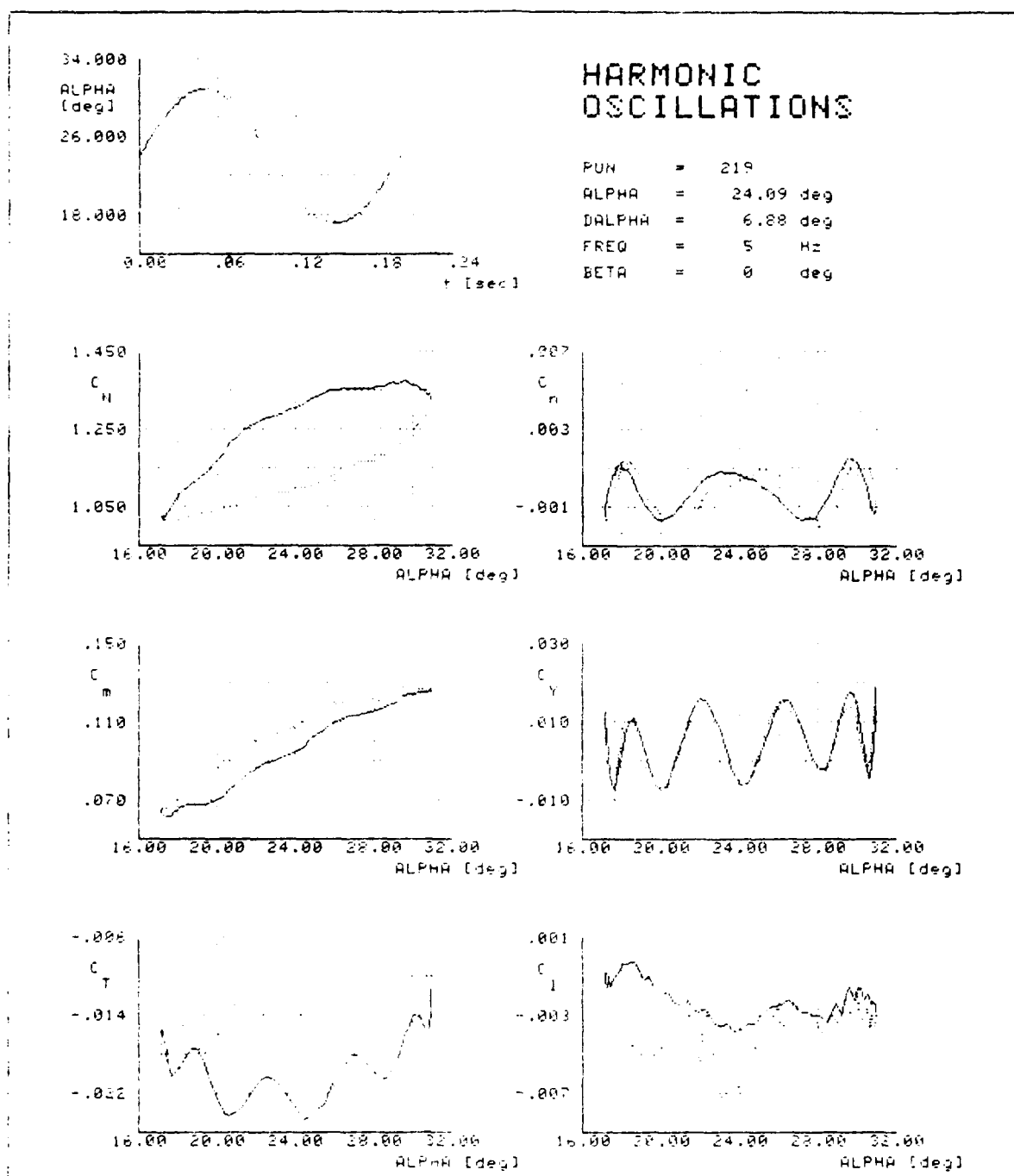


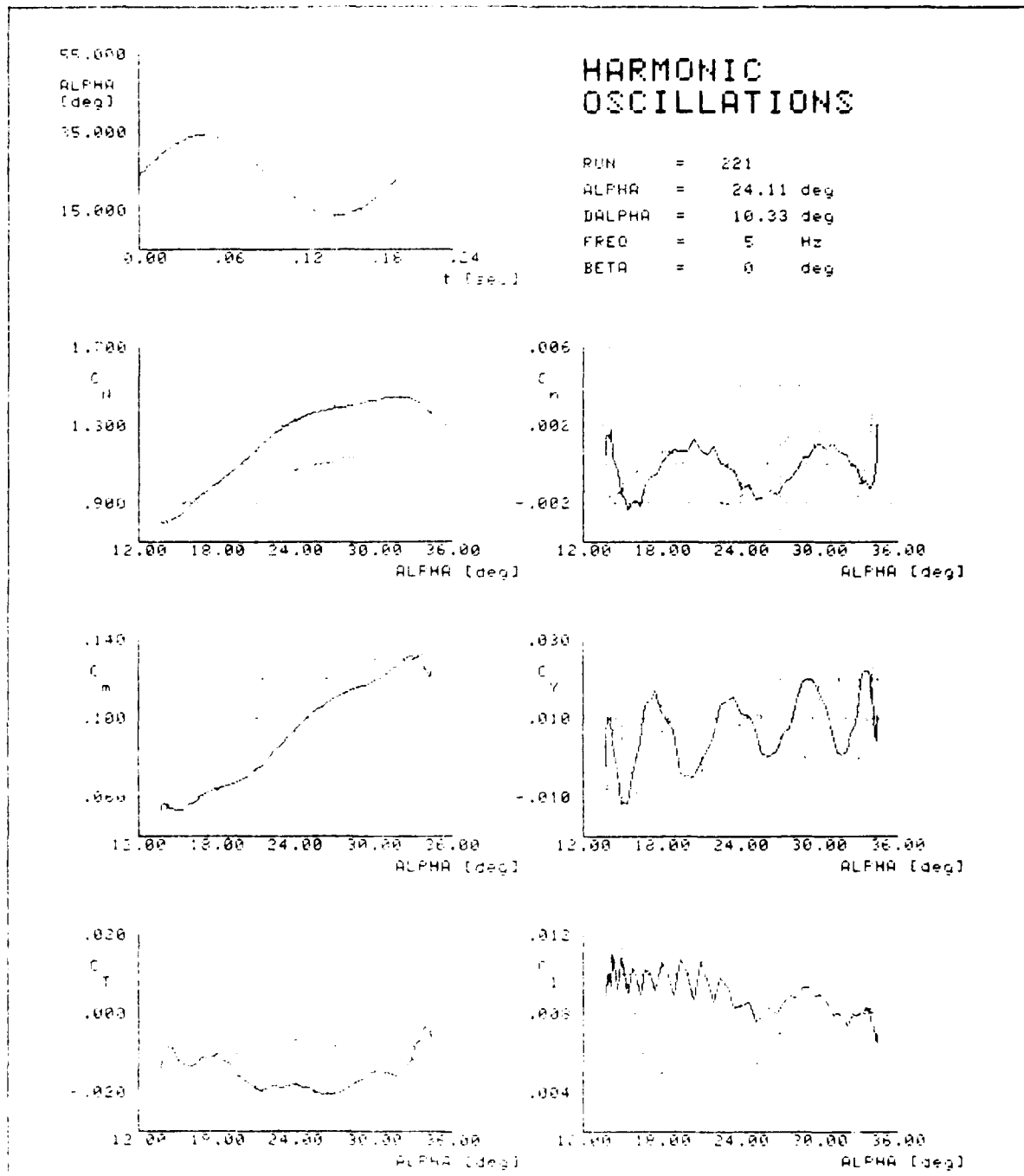


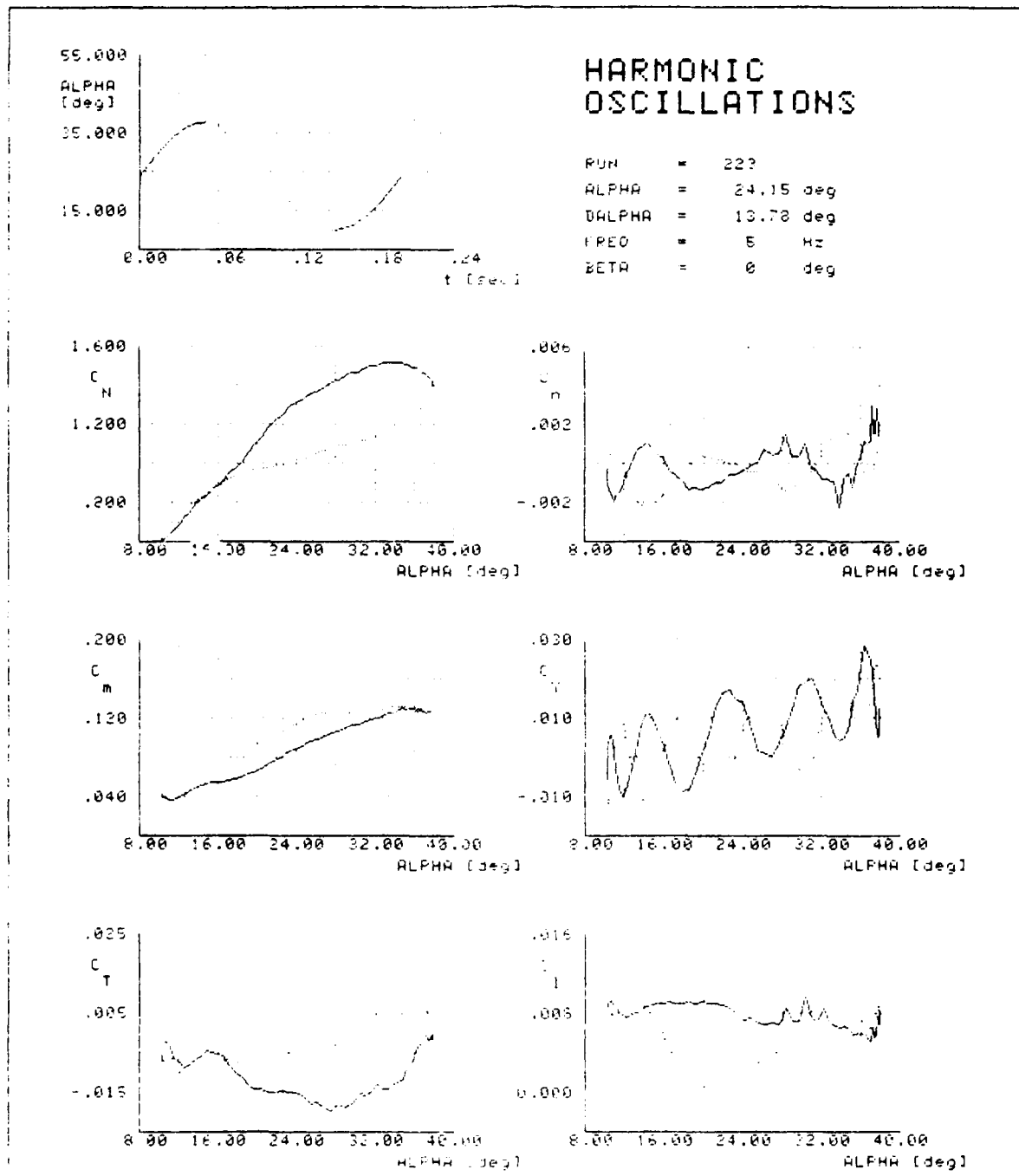


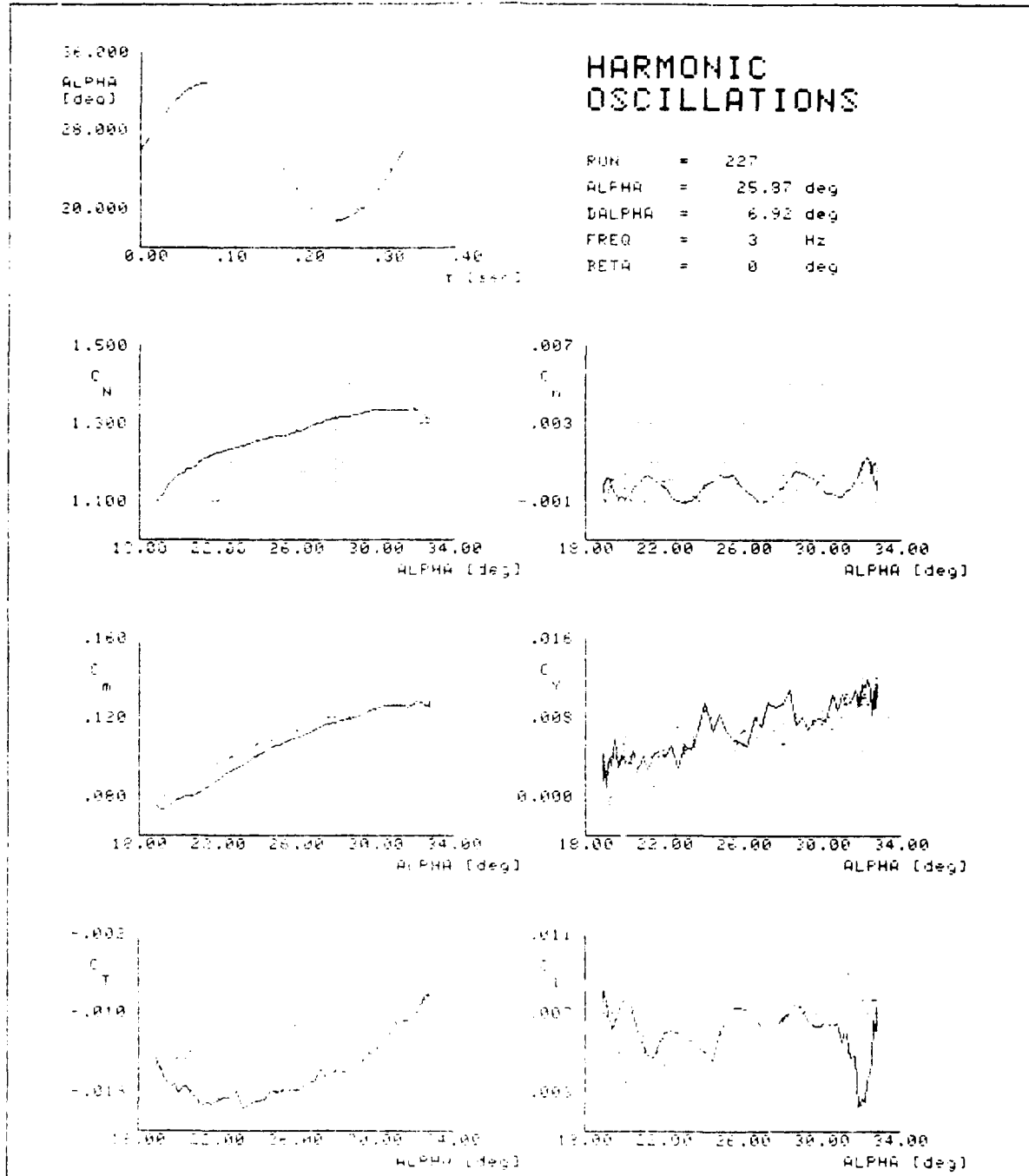


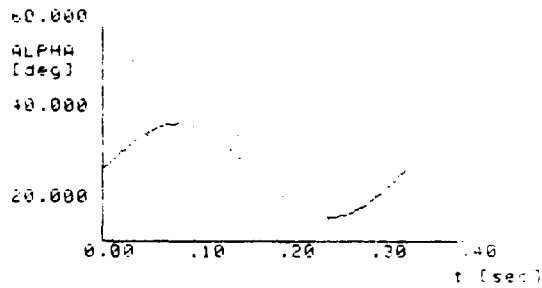






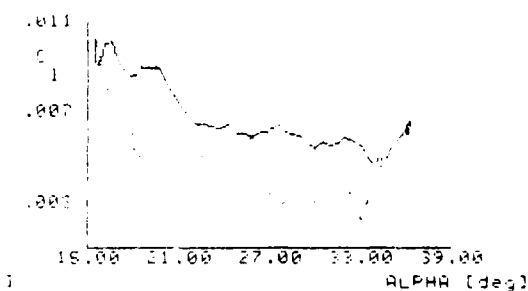
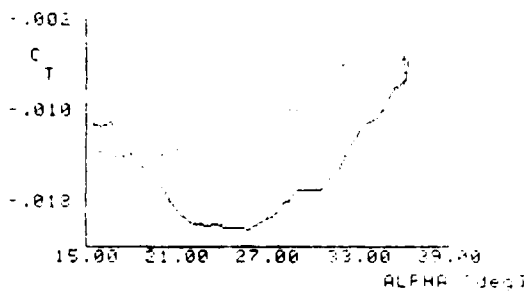
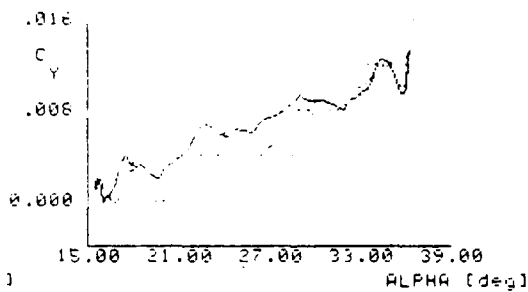
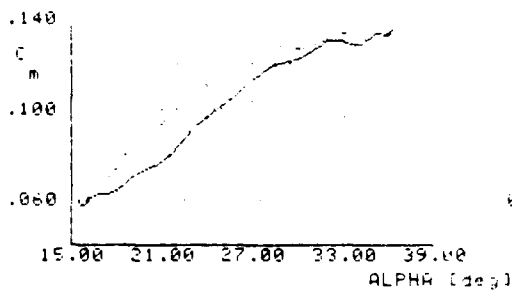
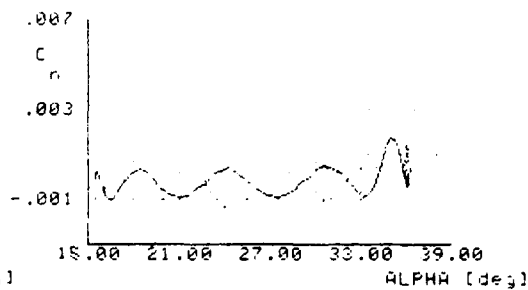
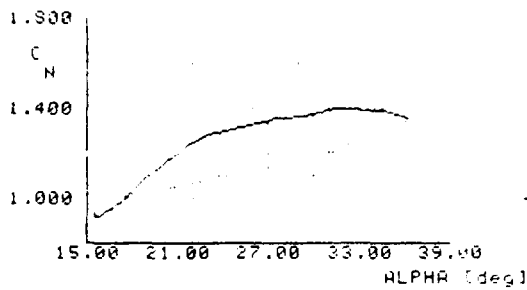


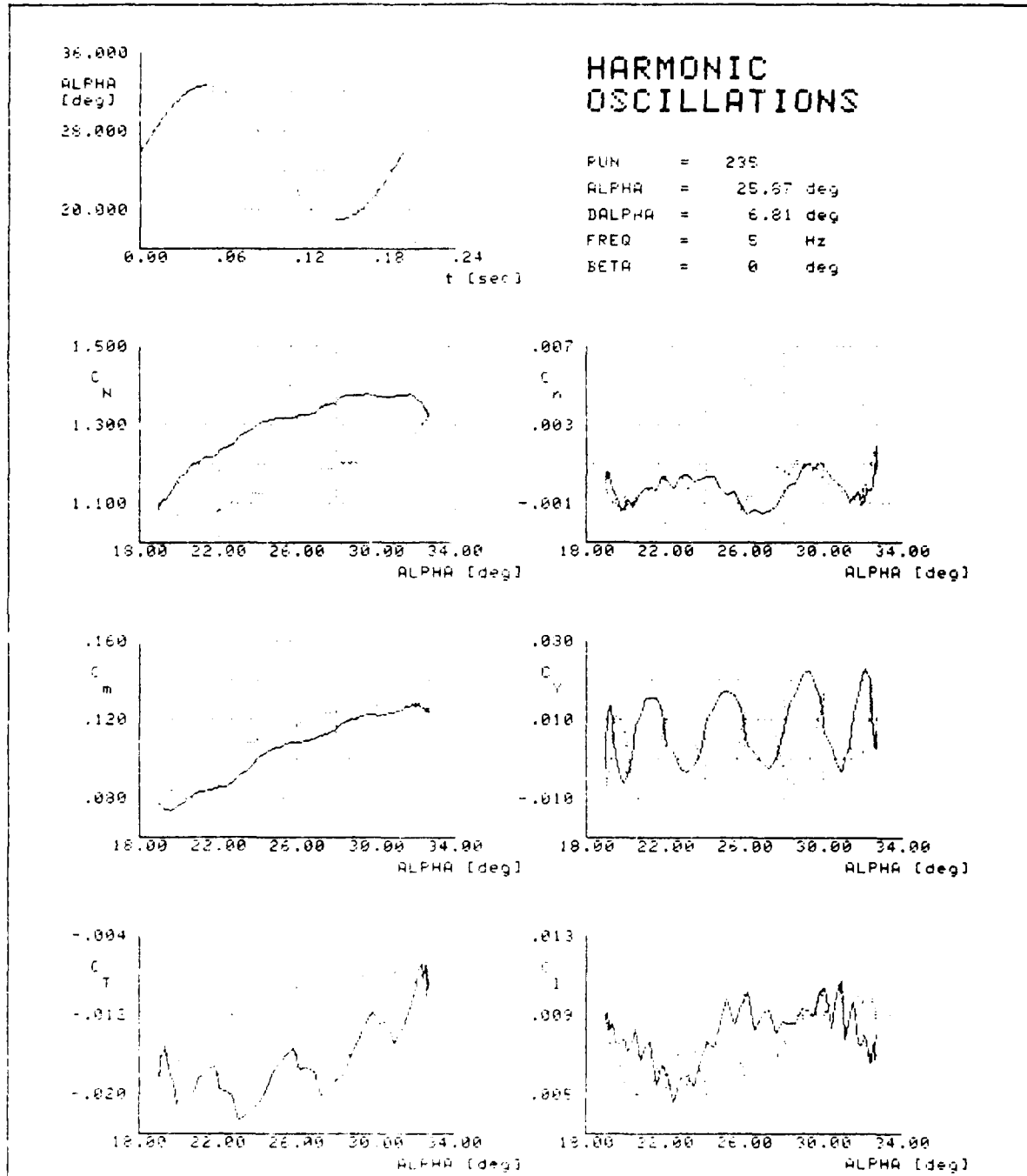


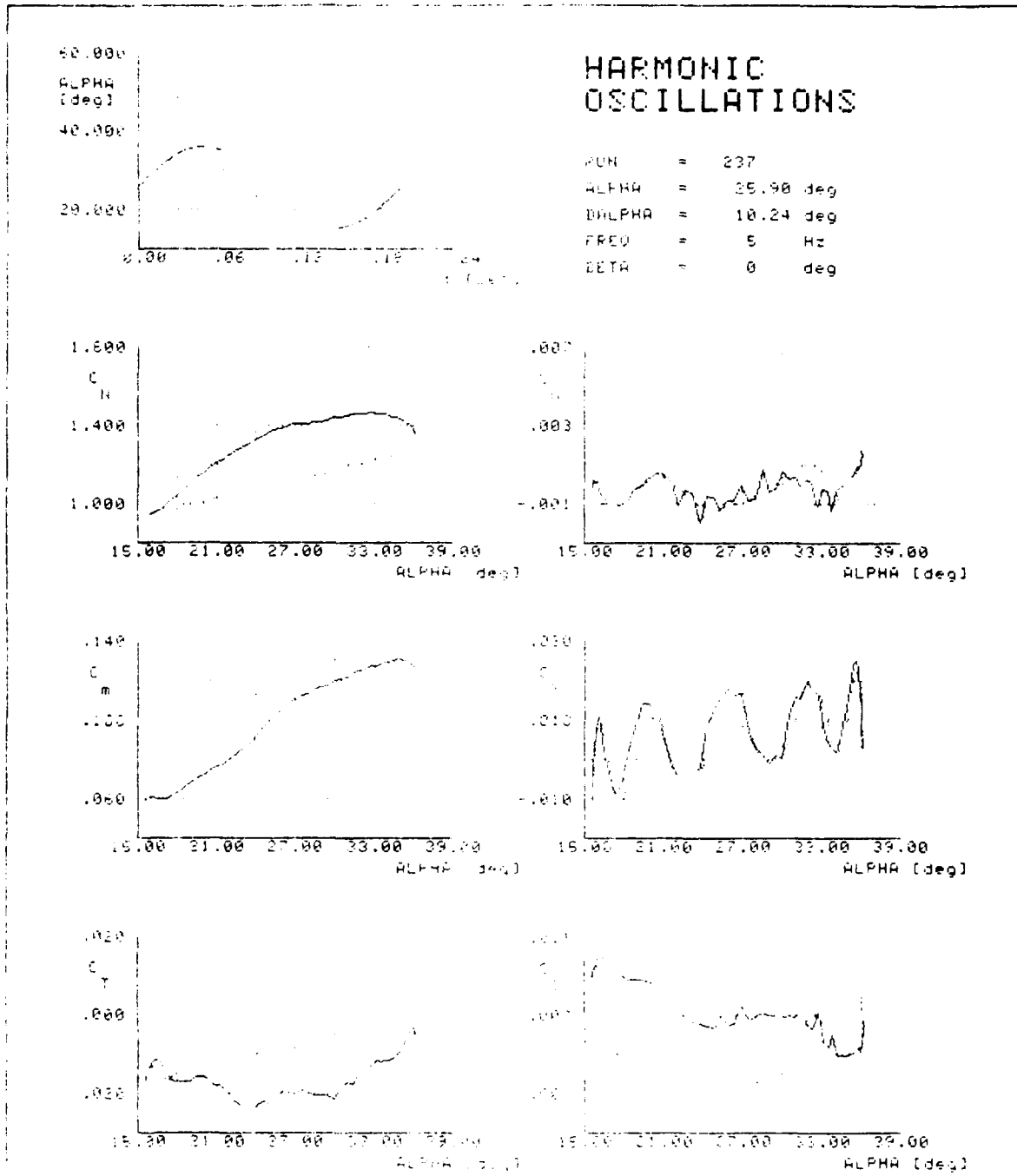


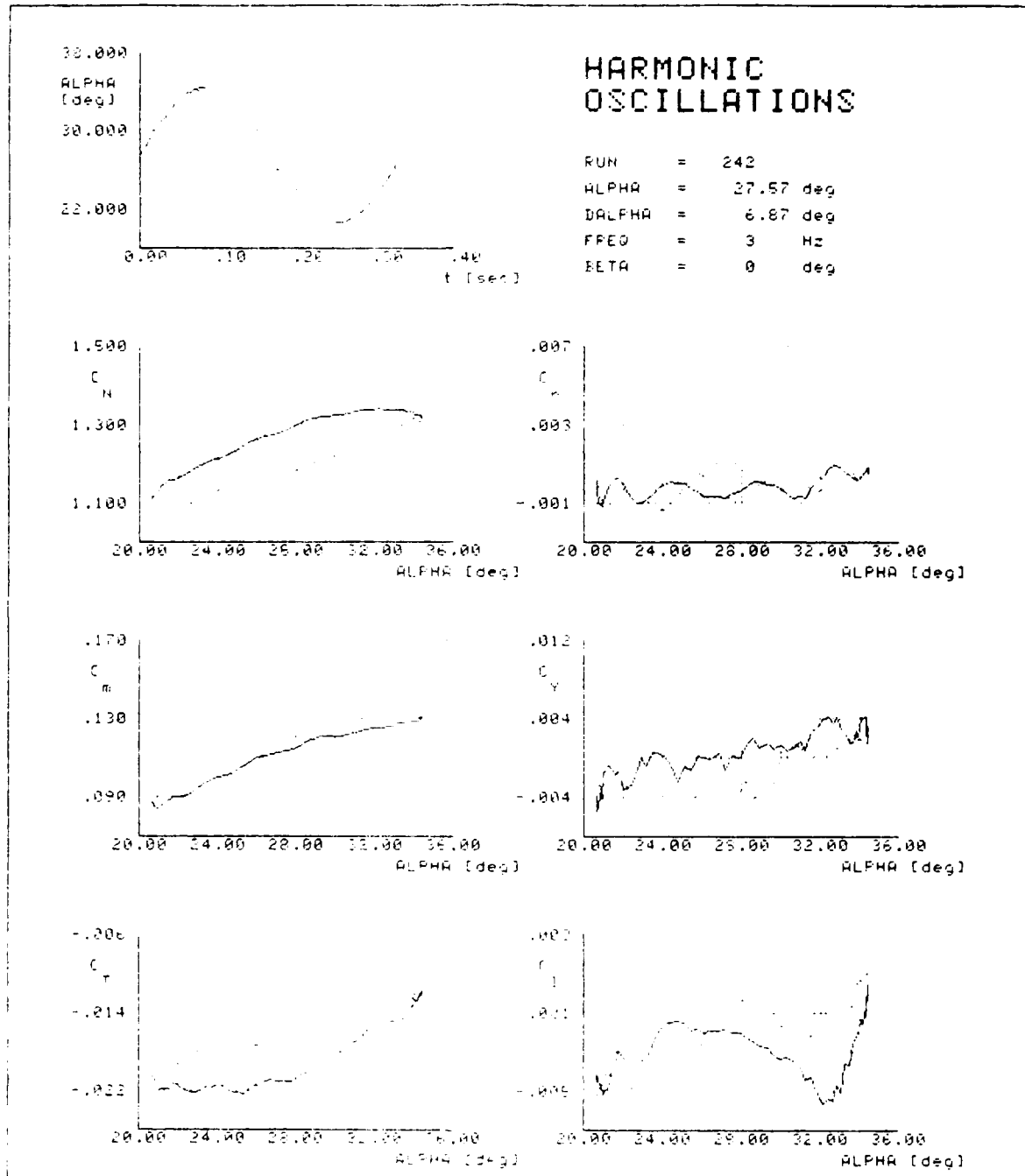
# HARMONIC OSCILLATIONS

RUN = 229  
ALPHA = 25.39 deg  
DALPHA = 10.36 deg  
FREQ = 3 Hz  
BETA = 0 deg

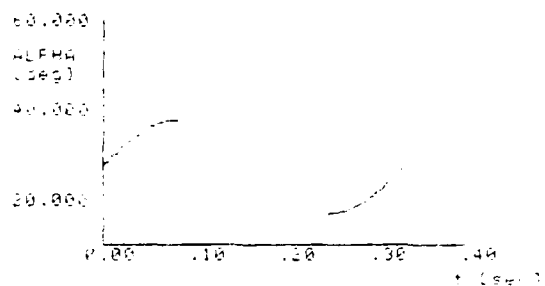






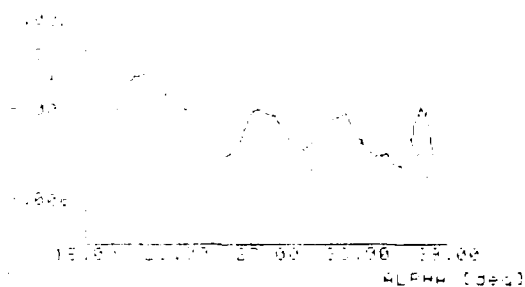
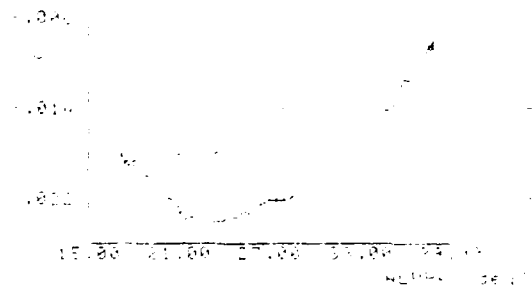
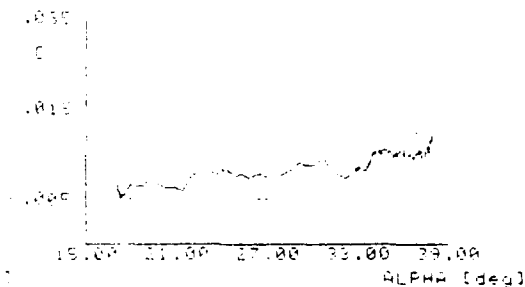
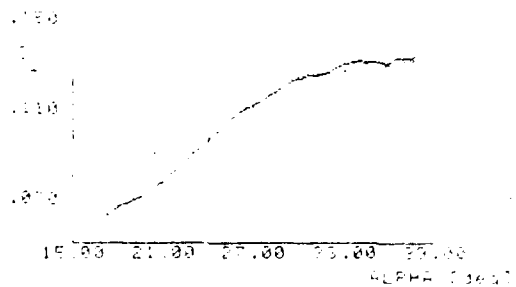
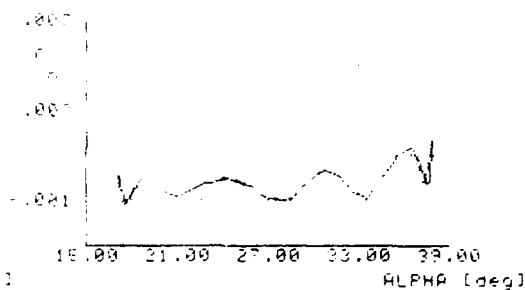
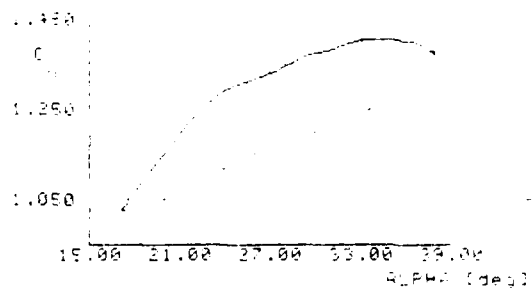


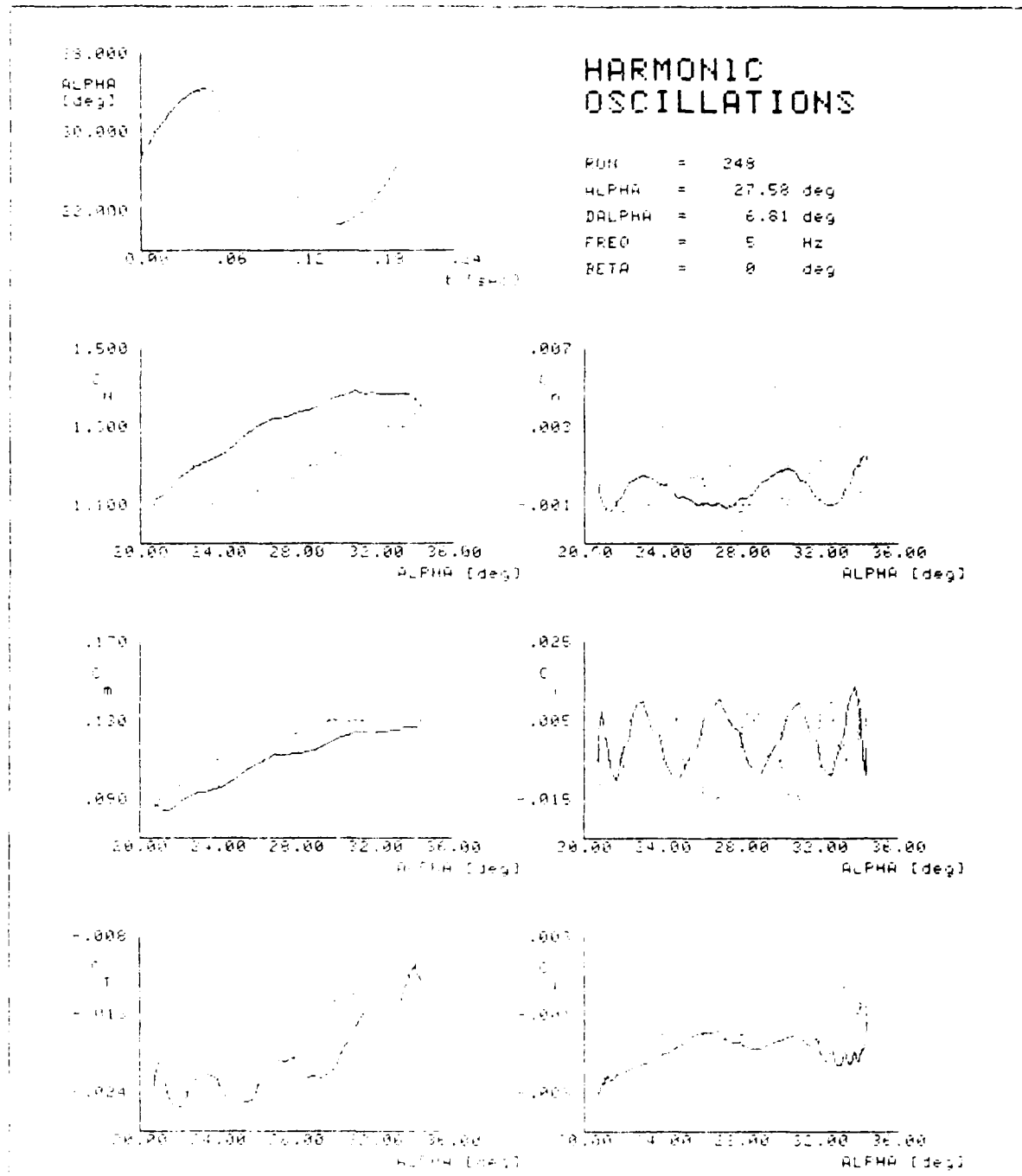


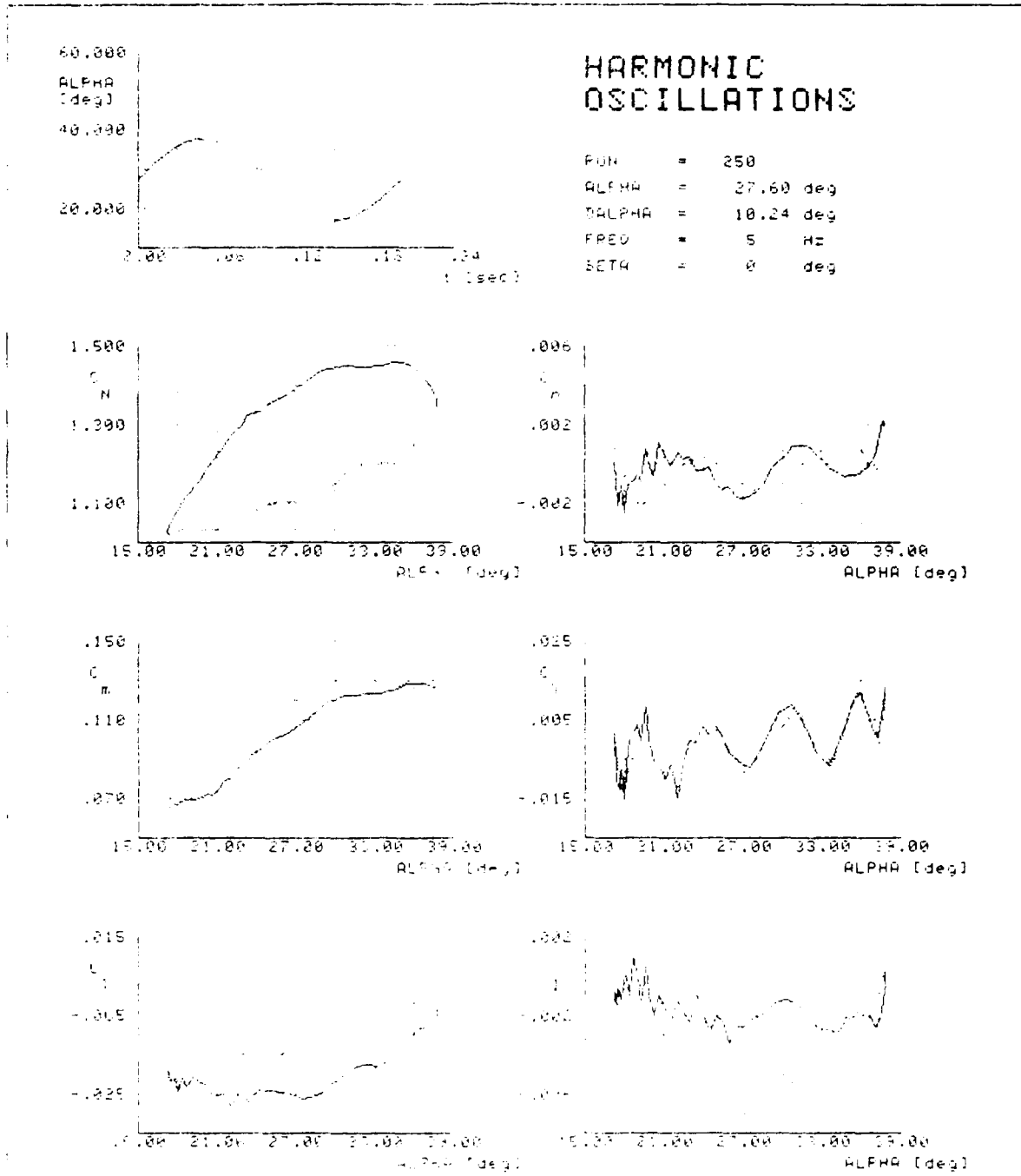


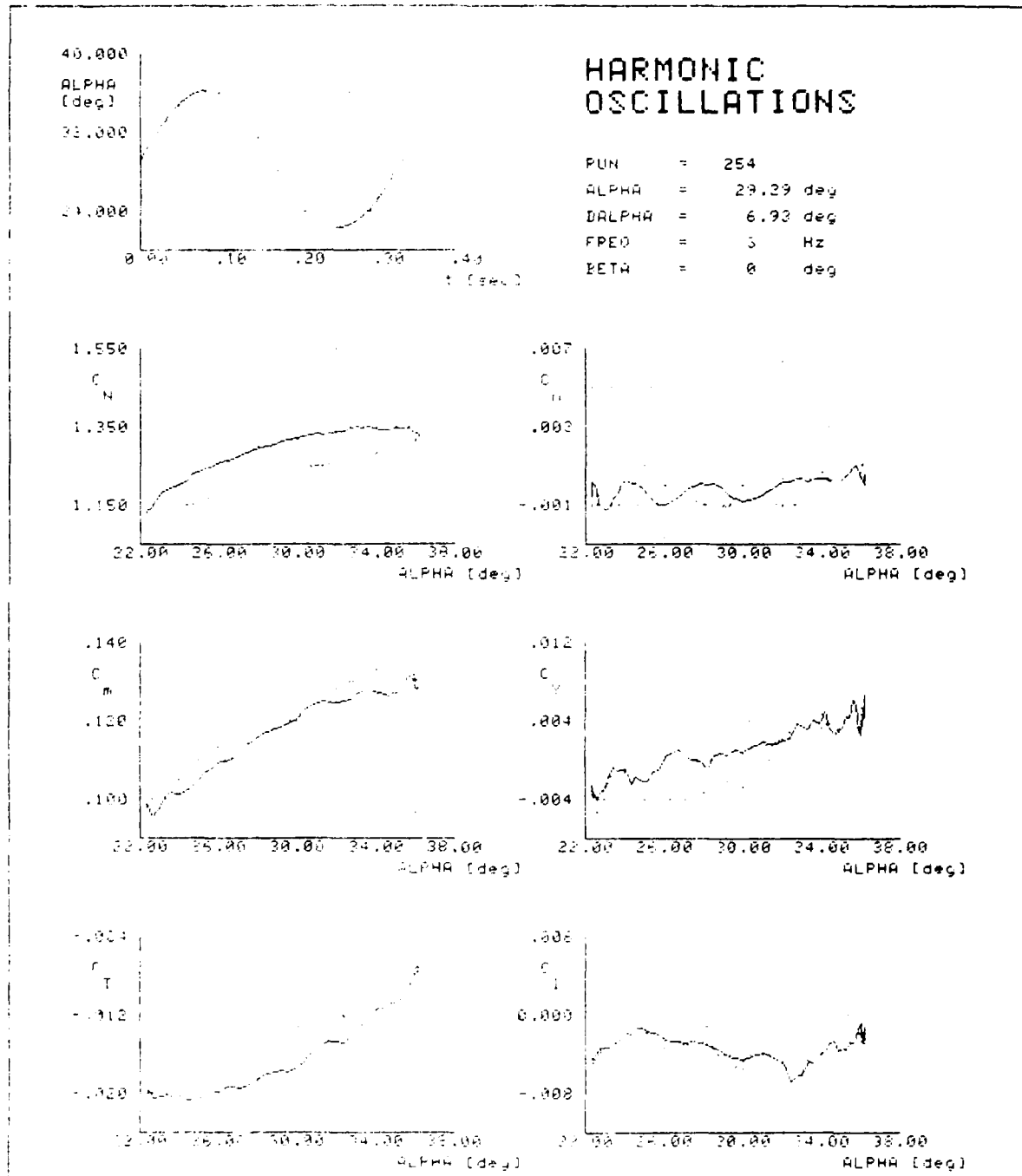
# HARMONIC OSCILLATIONS

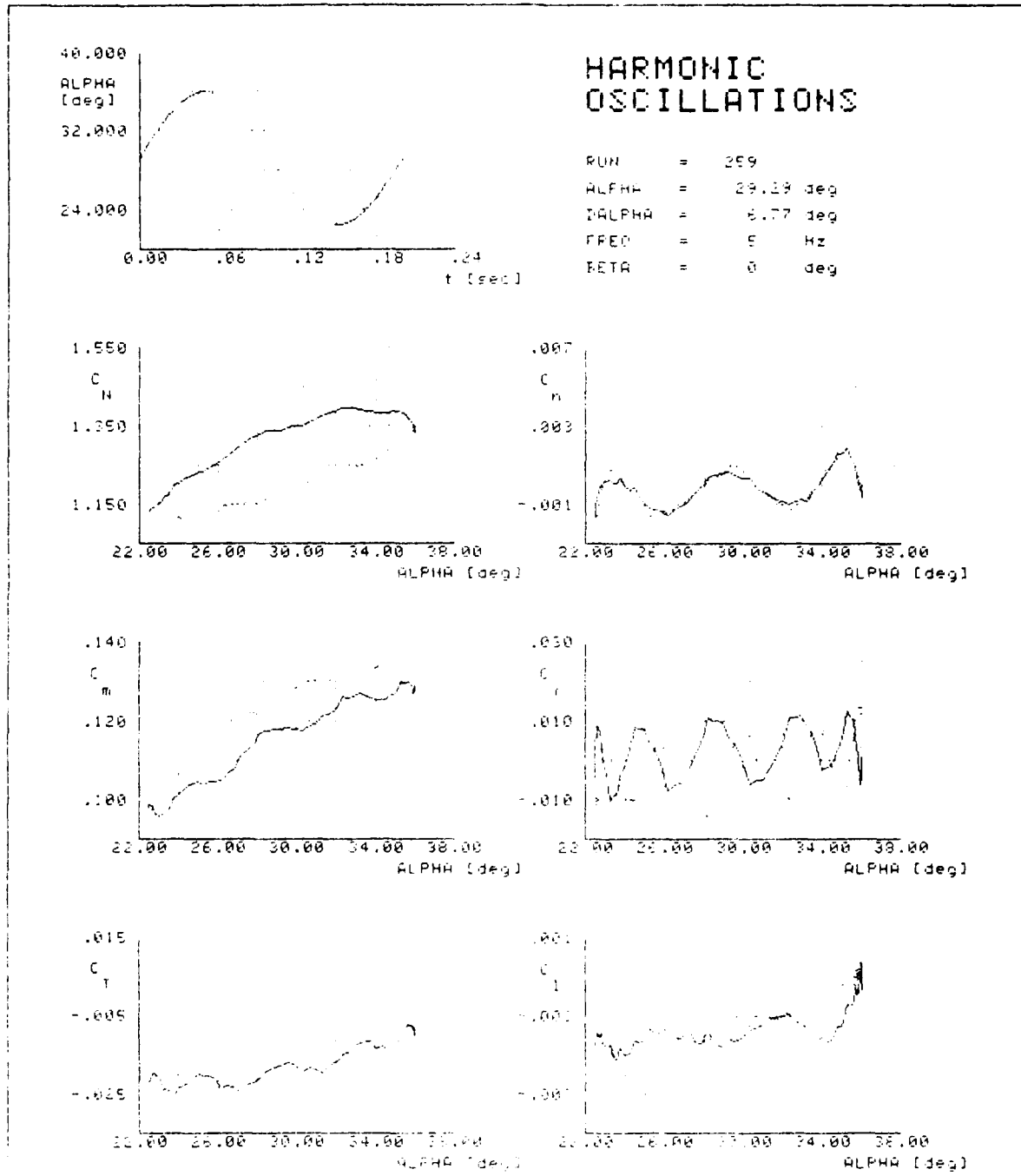
PUN = 344  
 ALPHA = 27.57 deg  
 DIALPHA = 10.35 deg  
 FREQ = 3 Hz  
 BETA = 0 deg

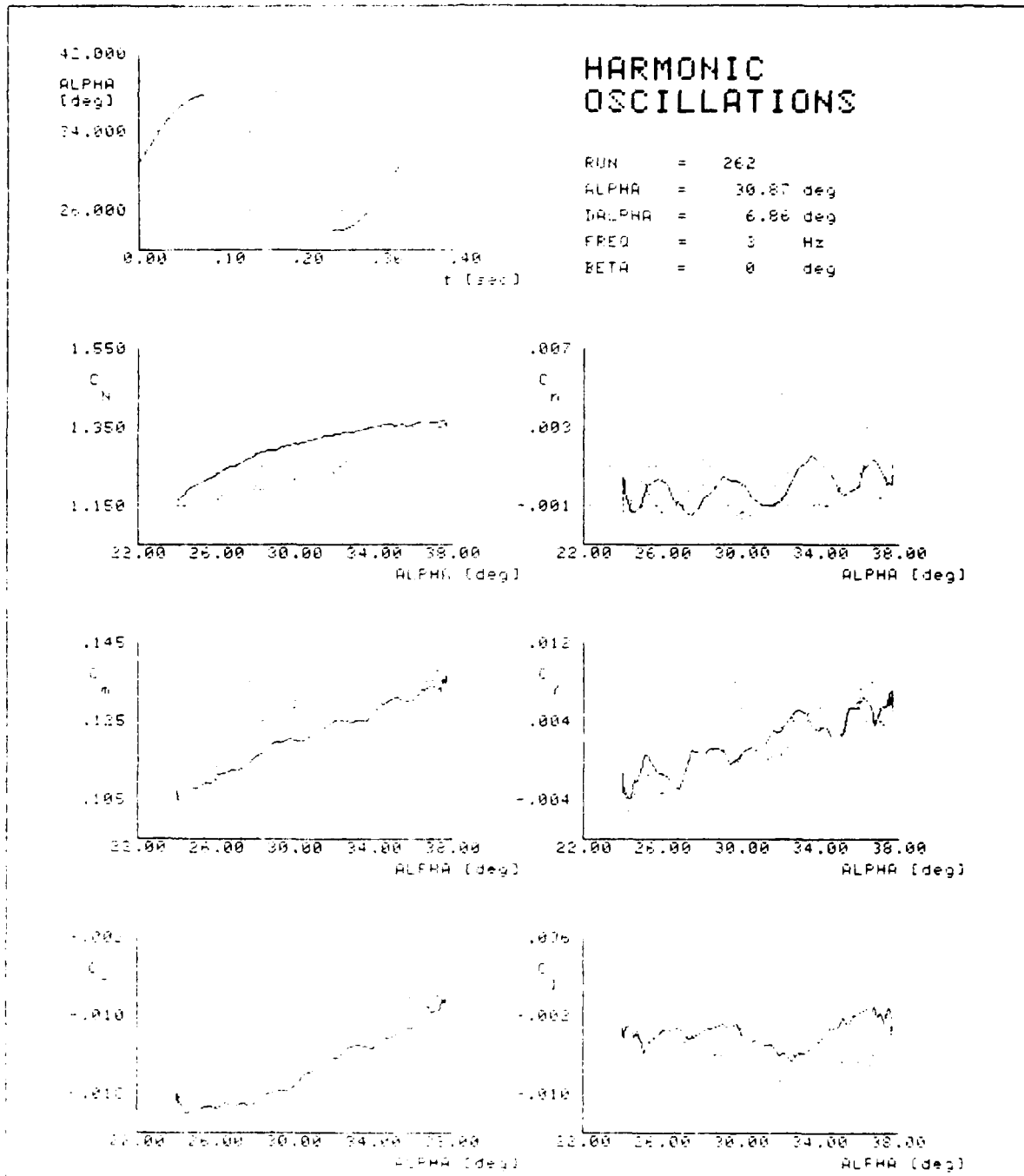


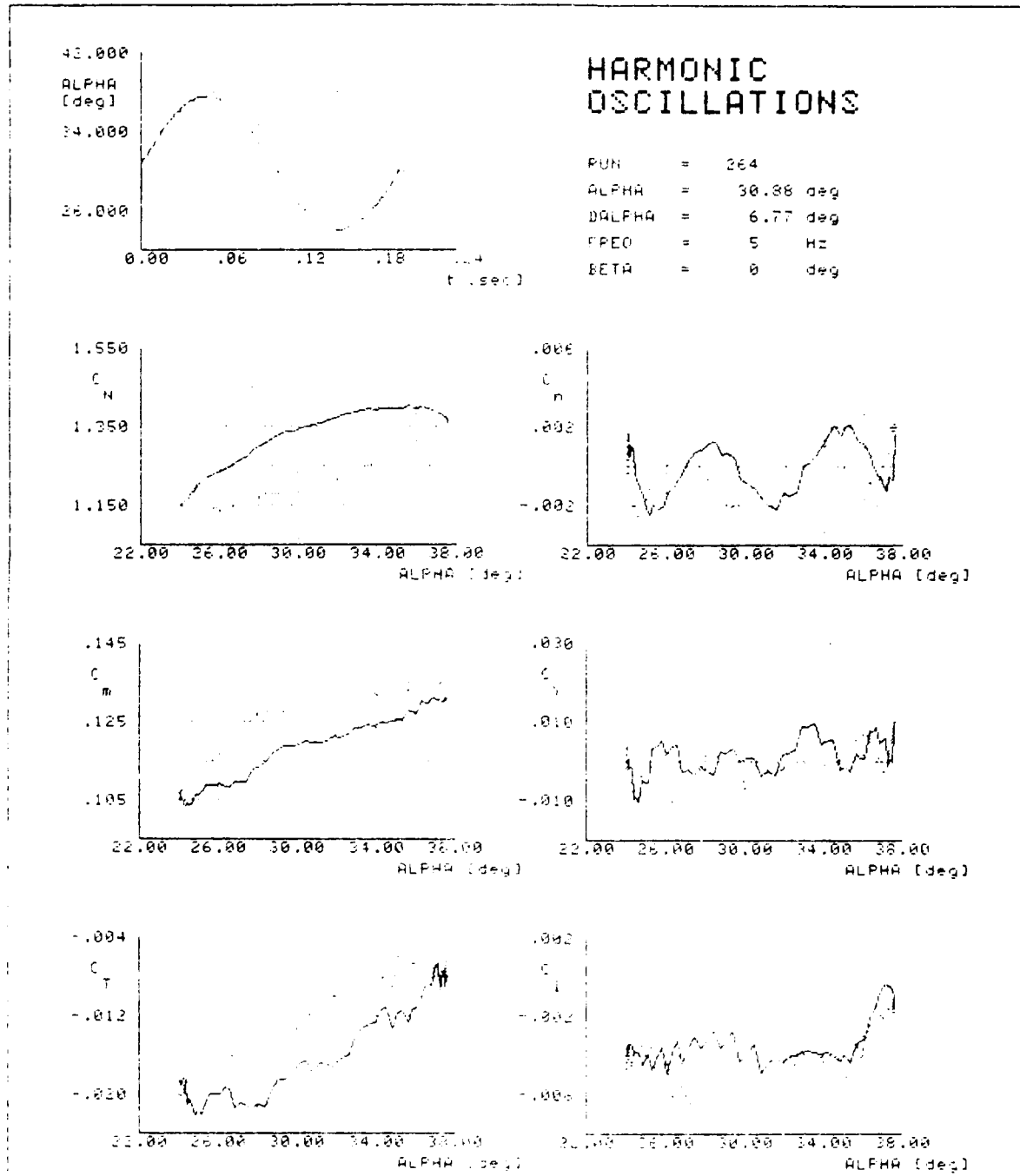


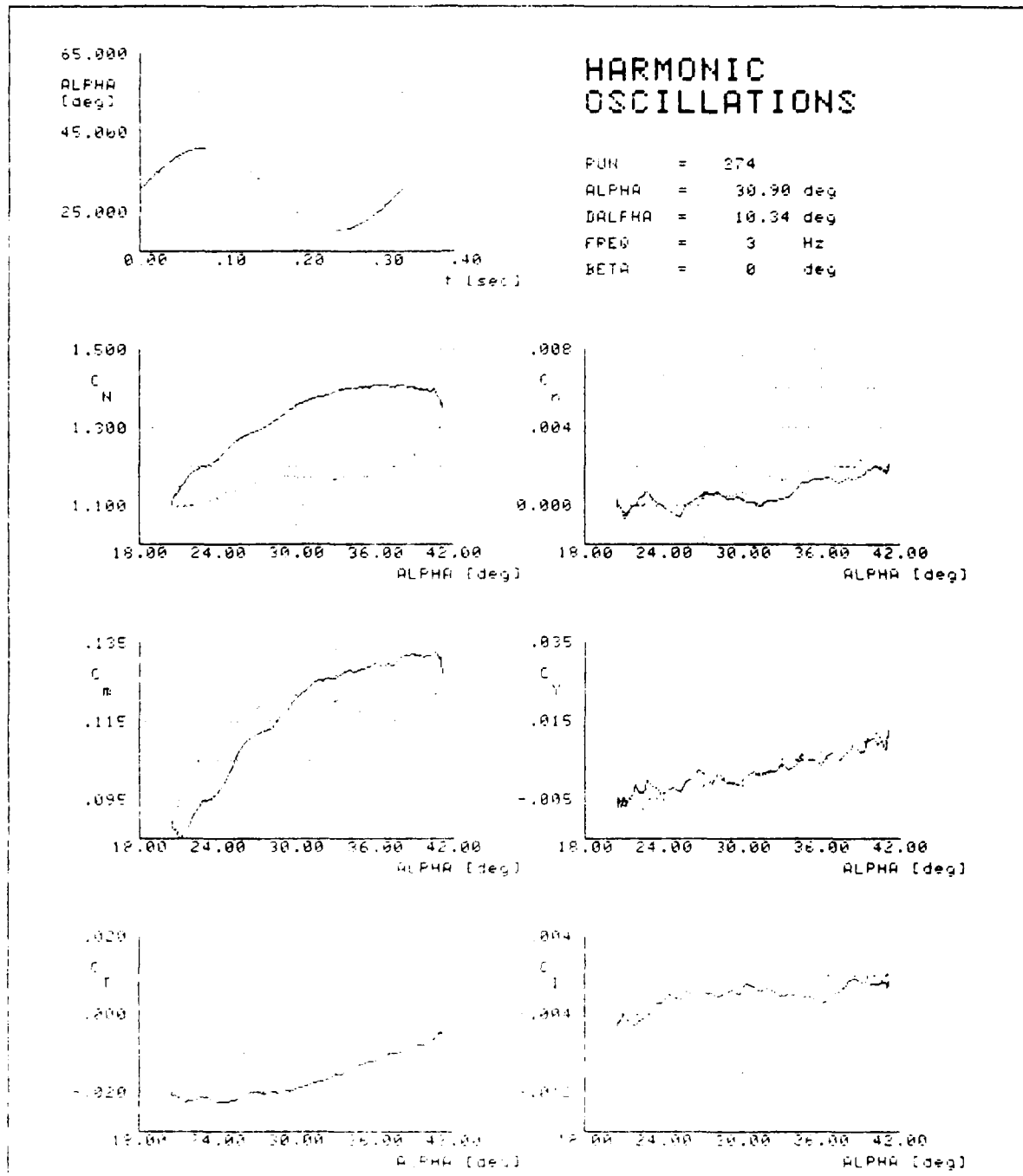




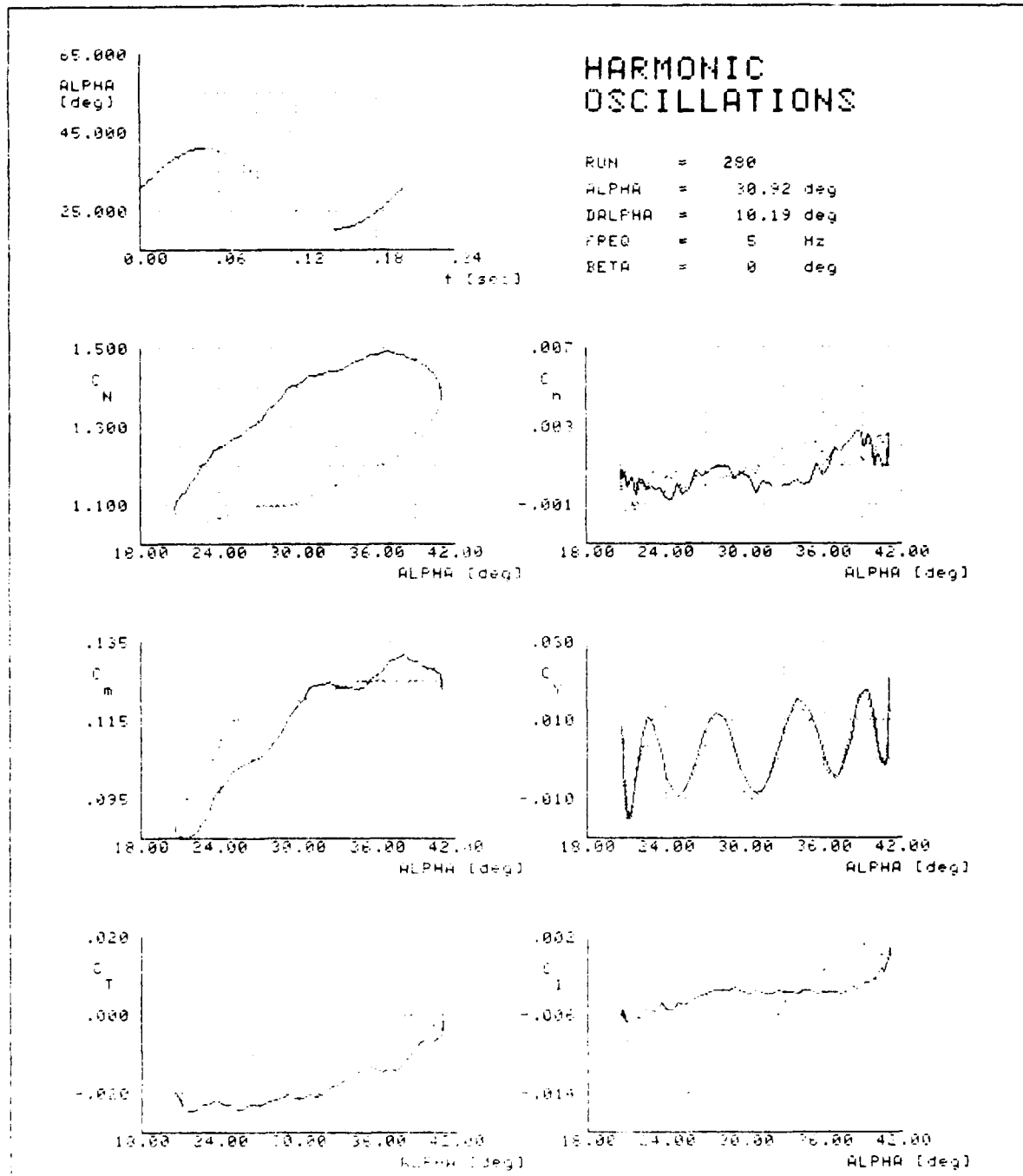


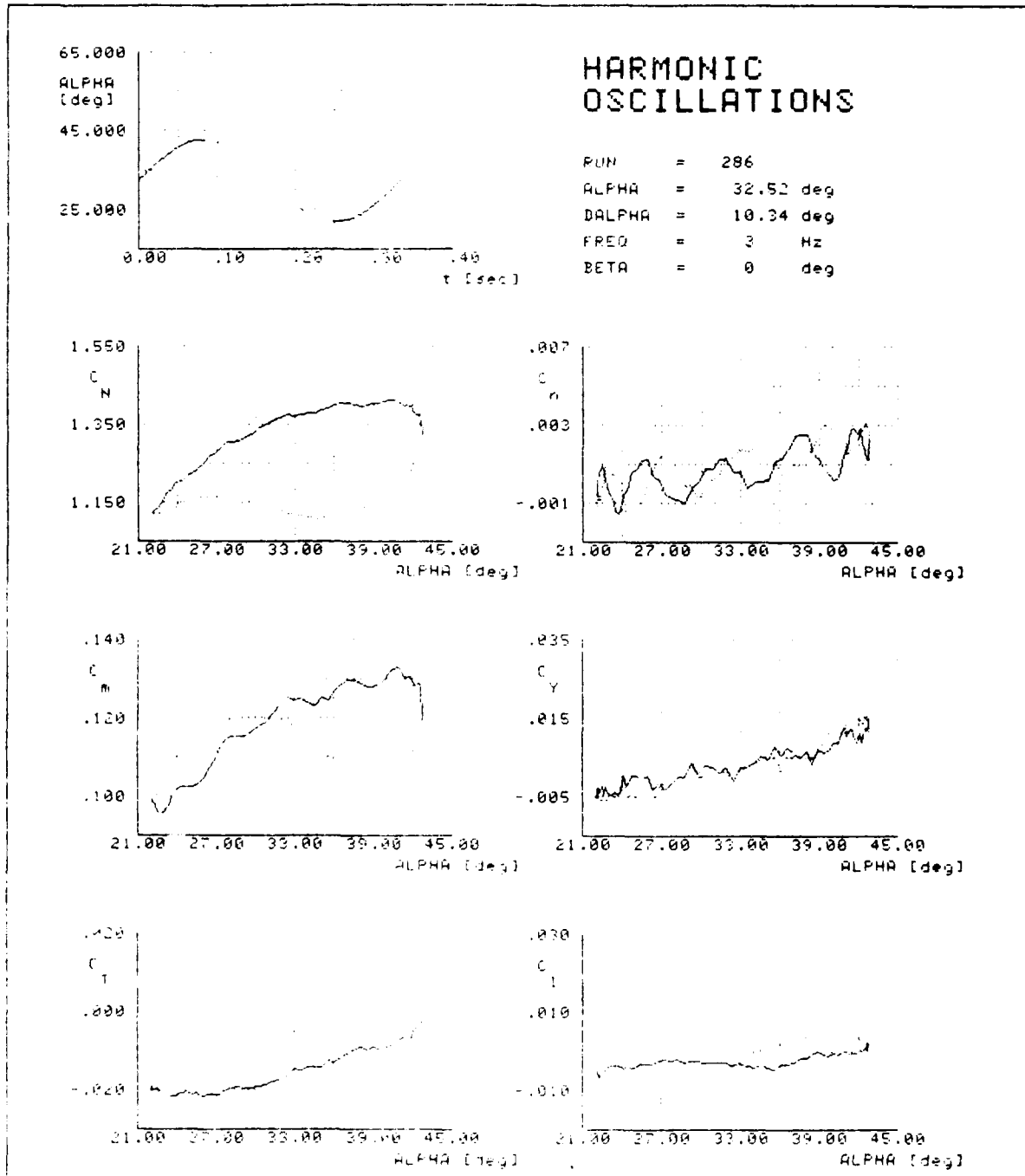


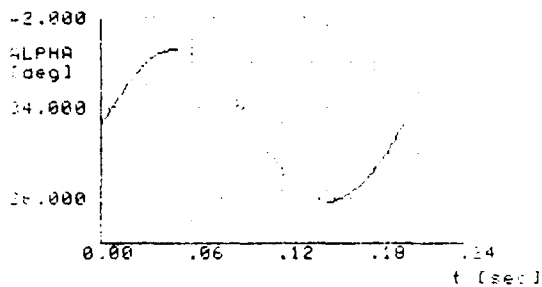






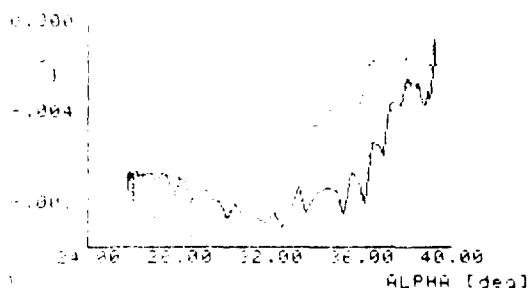
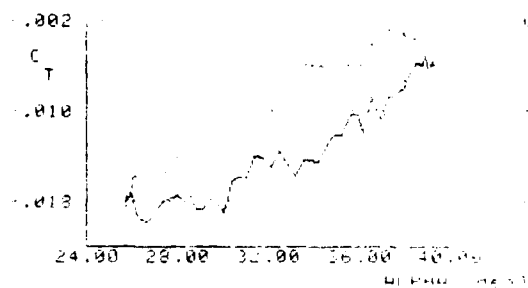
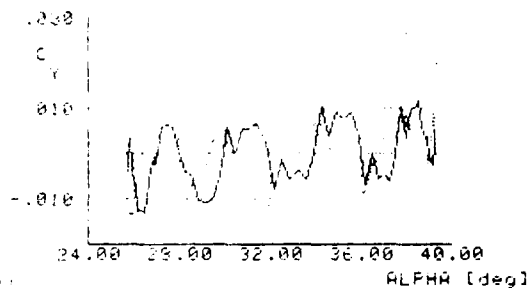
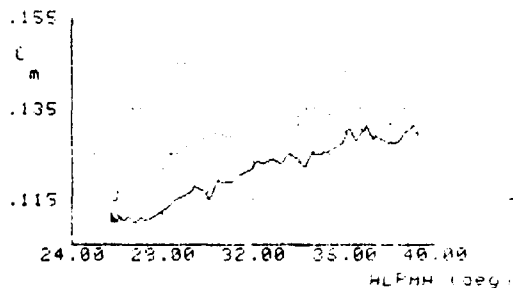
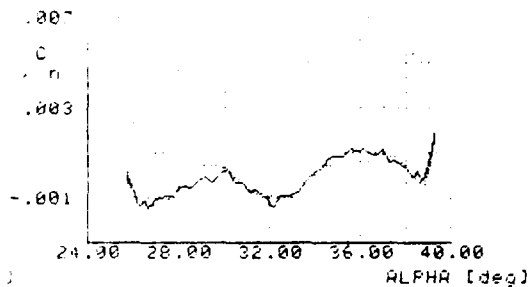
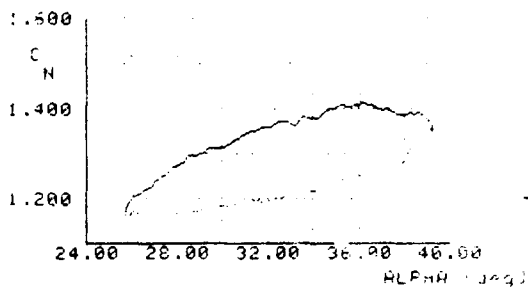


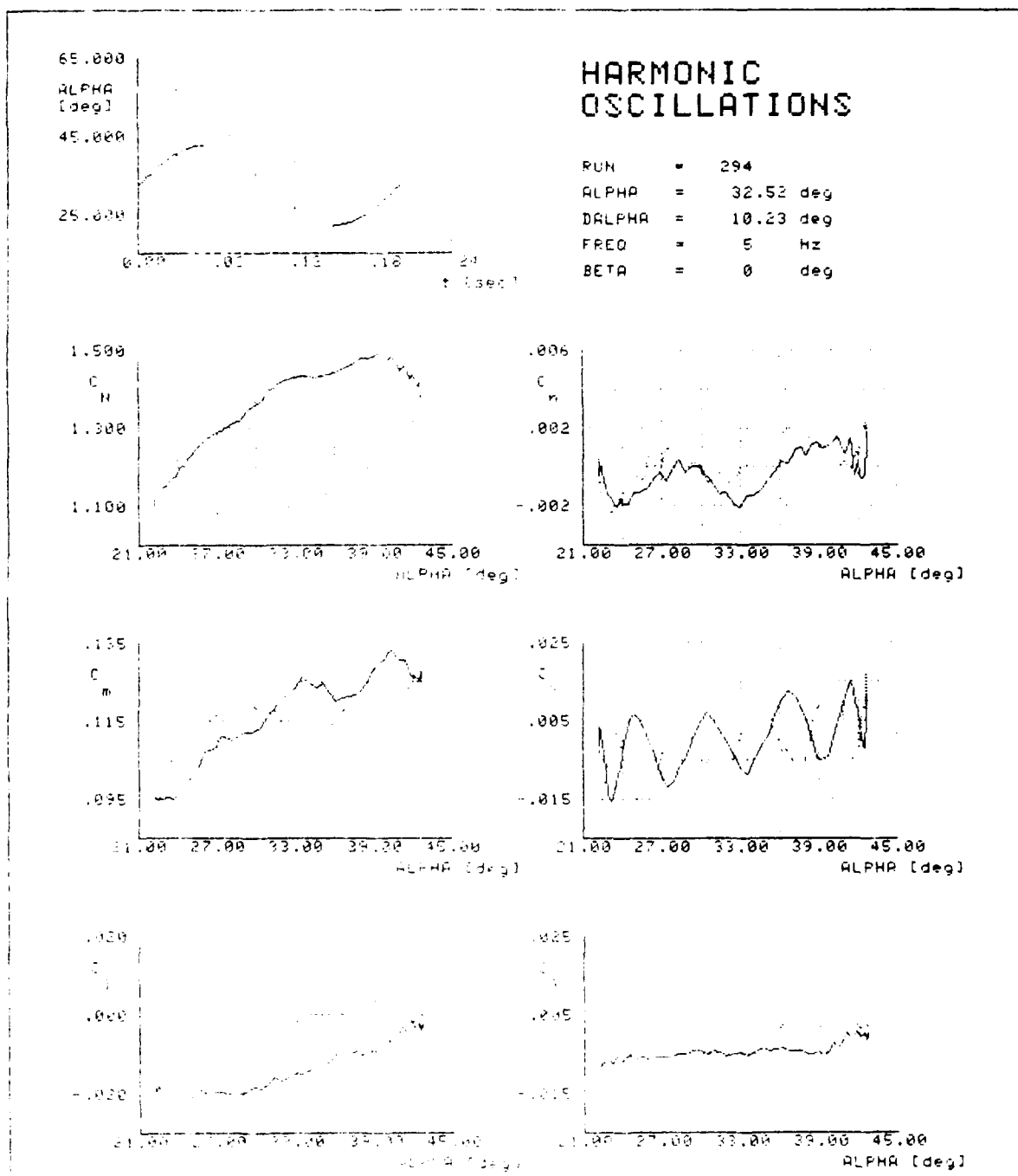


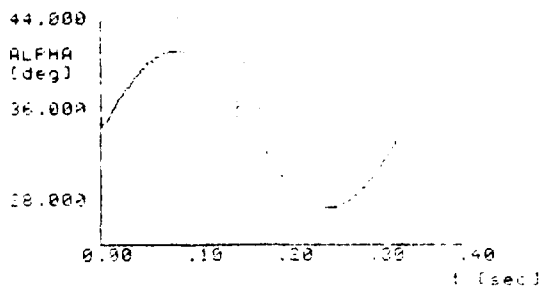


# HARMONIC OSCILLATIONS

PUN = 291  
ALPHA = 32.55 deg  
DALPHA = 6.76 deg  
FREQ = 5 Hz  
BETA = 0 deg

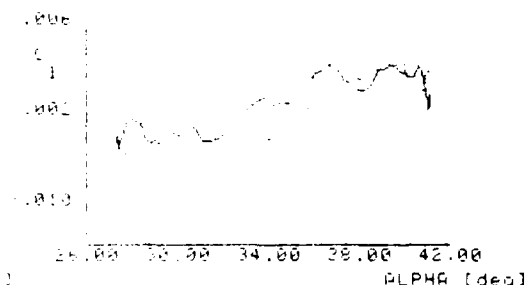
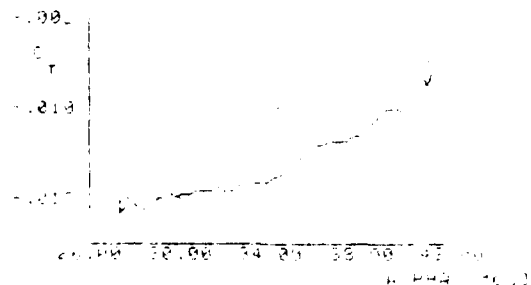
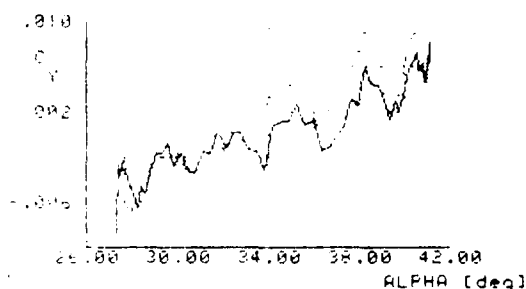
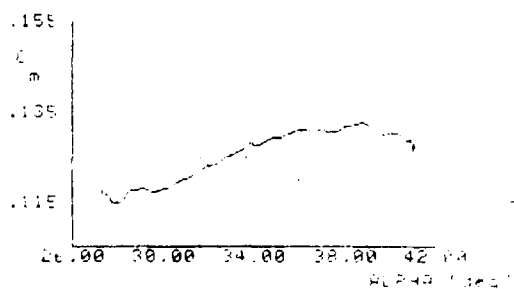
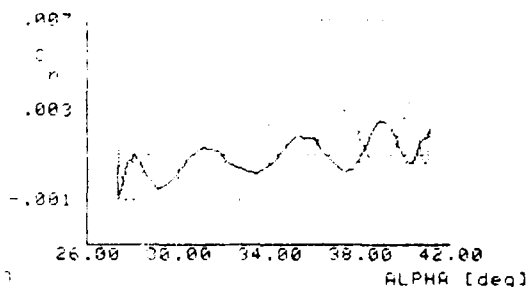
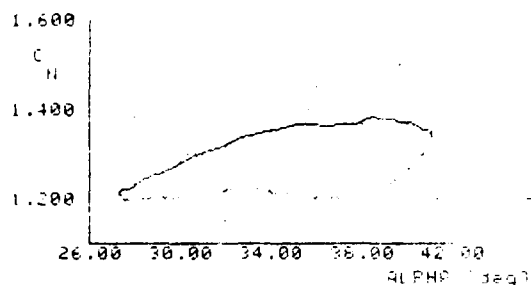


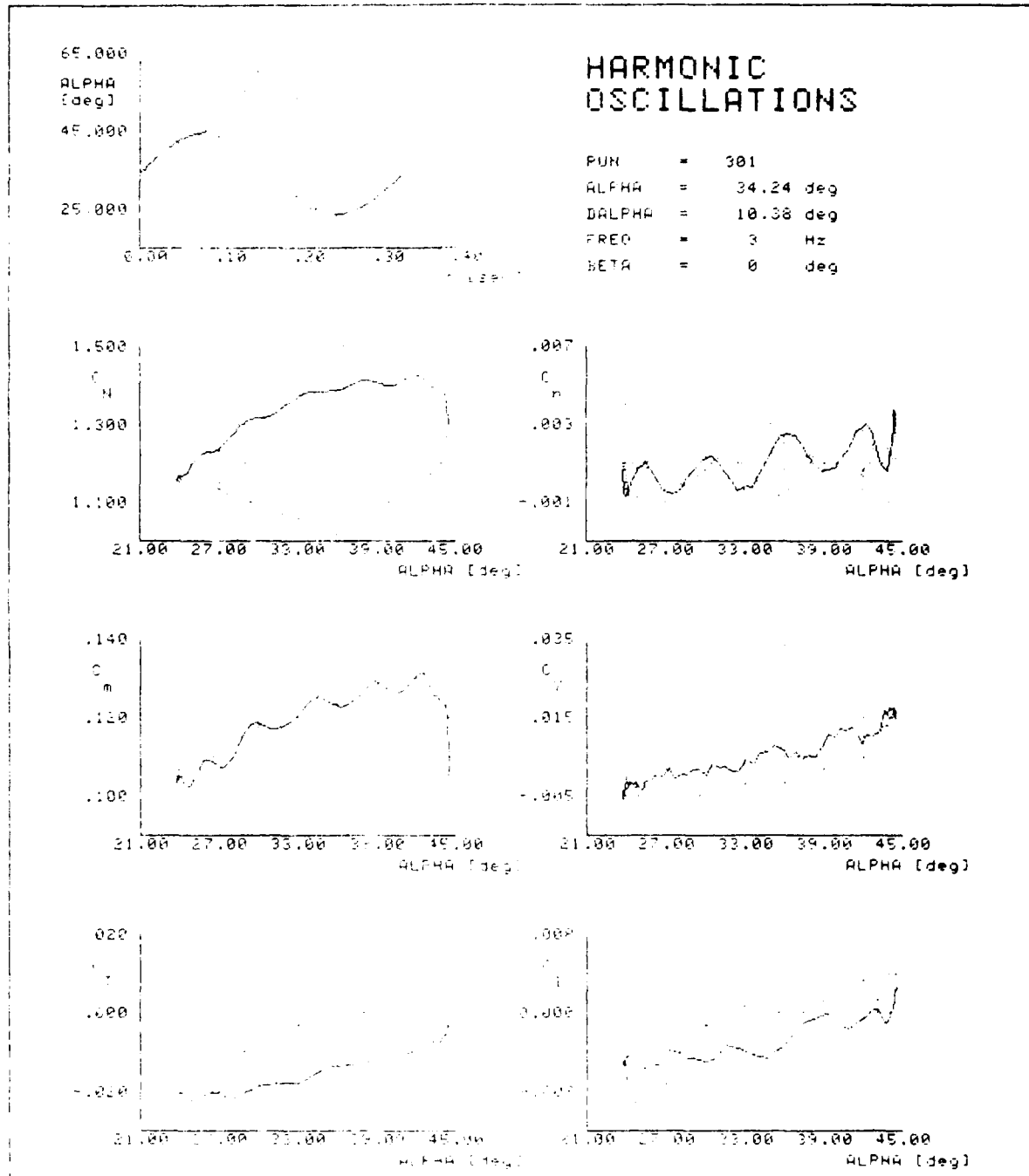


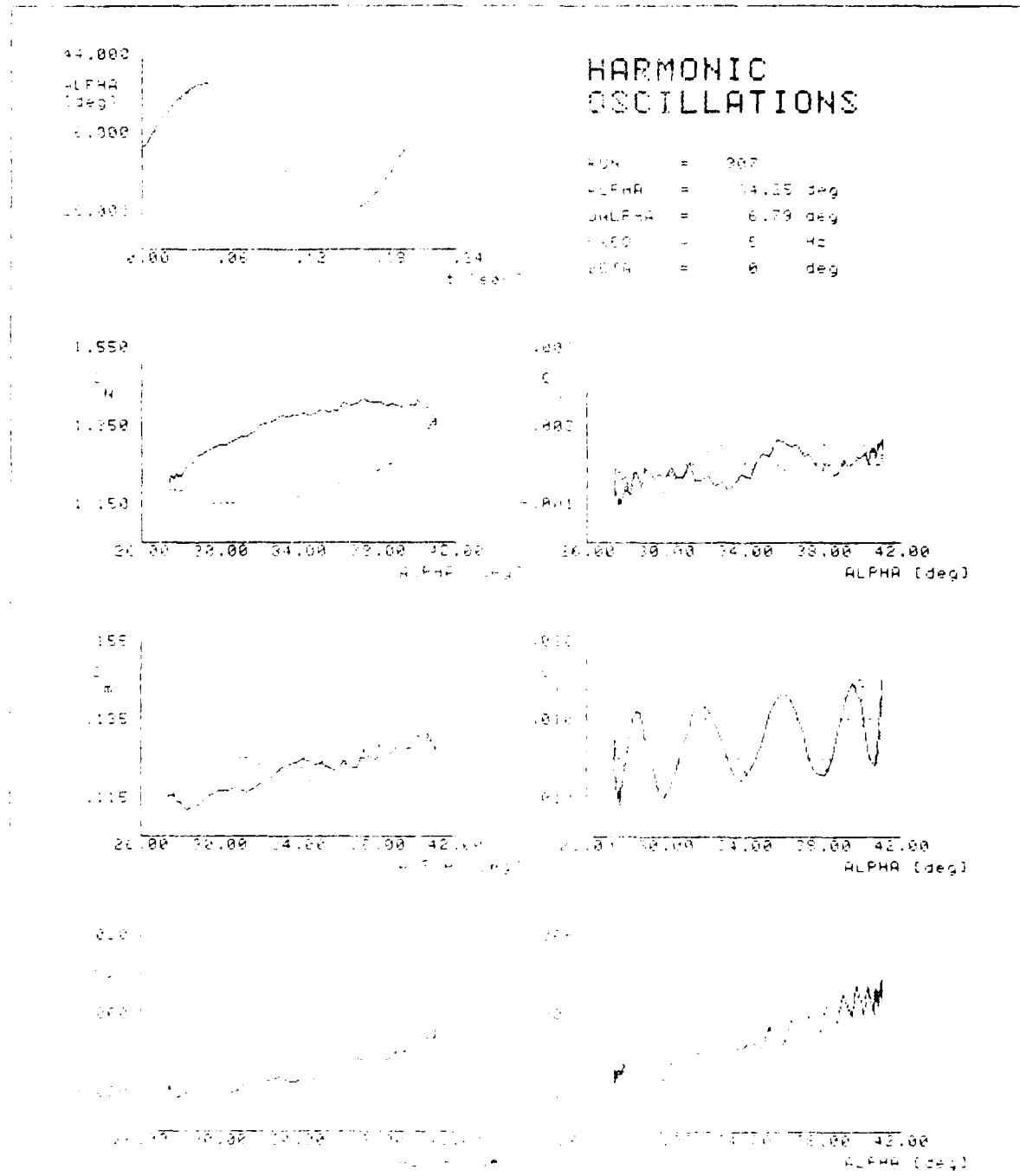


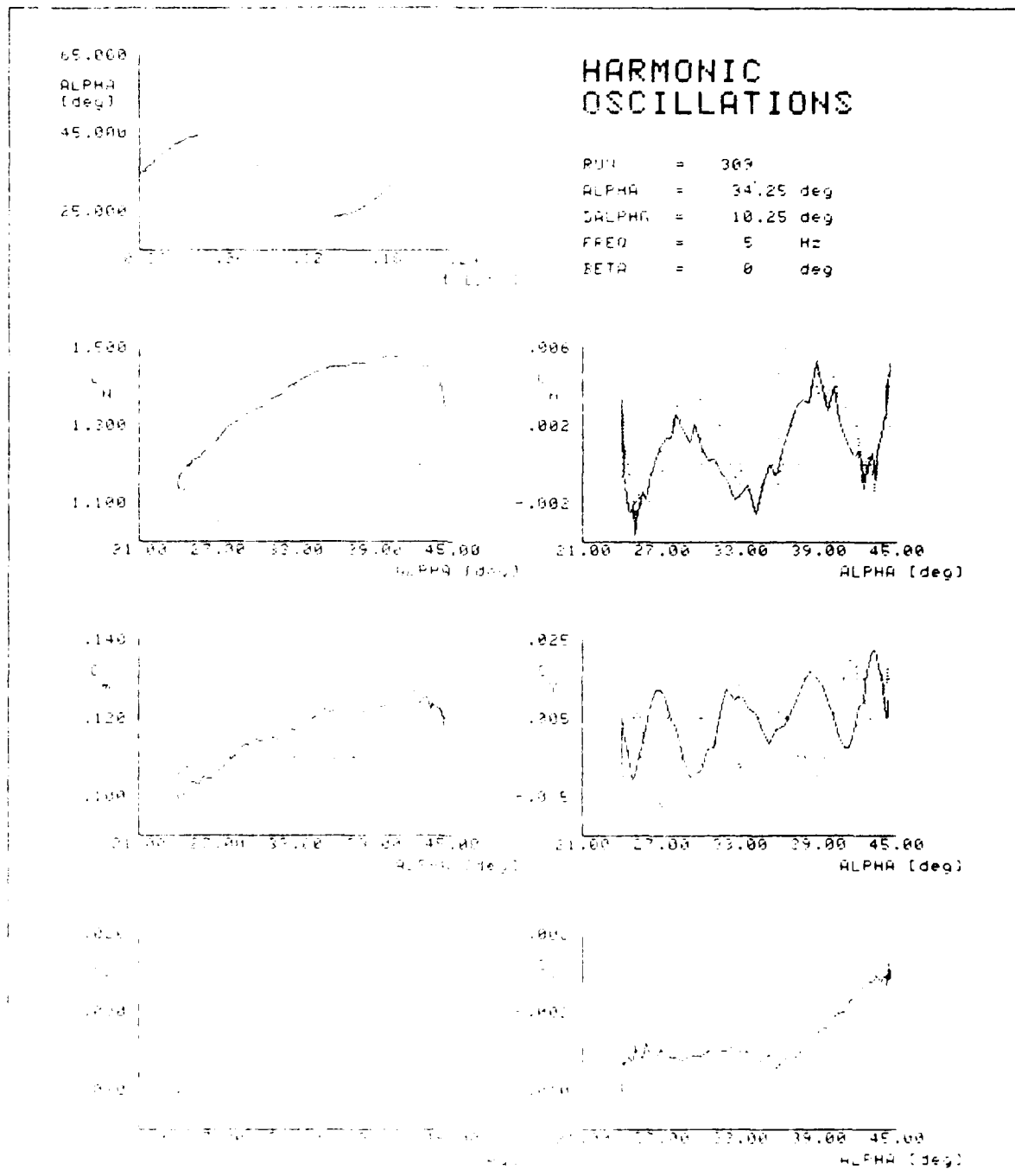
# HARMONIC OSCILLATIONS

FUN = 299  
 ALPHA = 34.23 deg  
 D ALPHA = 6.69 deg  
 FREQ = 3 Hz  
 DELTA = 0 deg

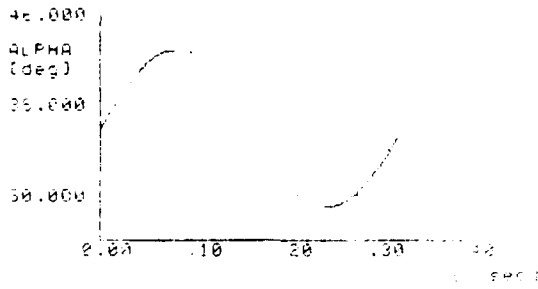






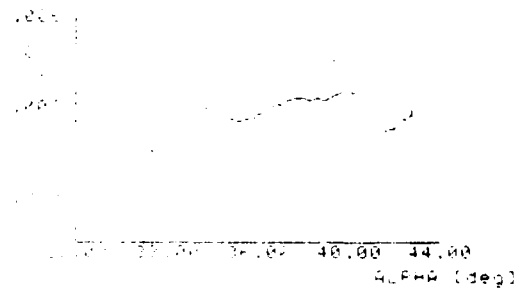
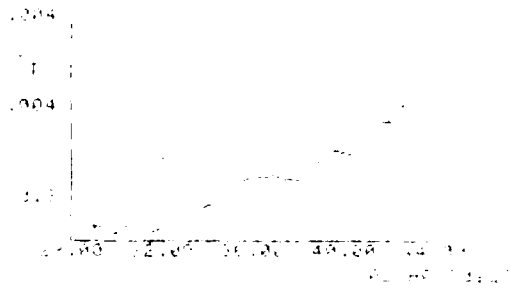
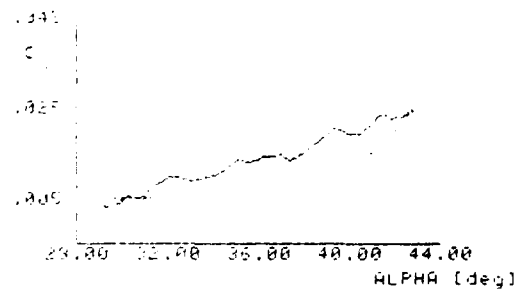
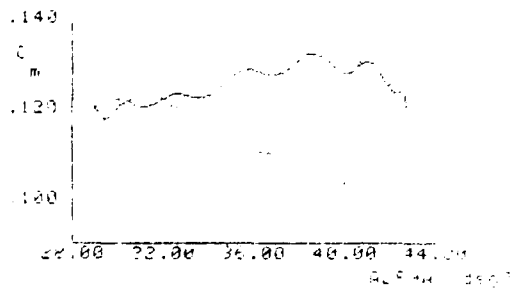
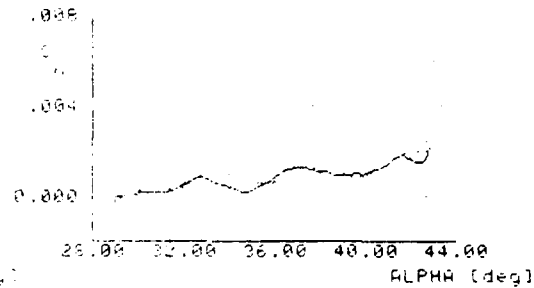
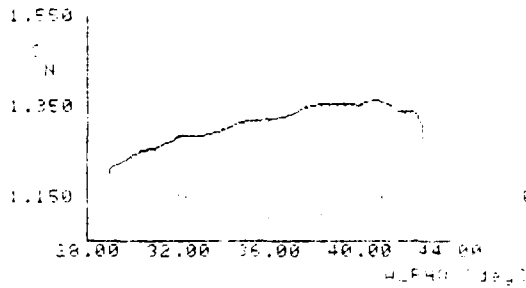


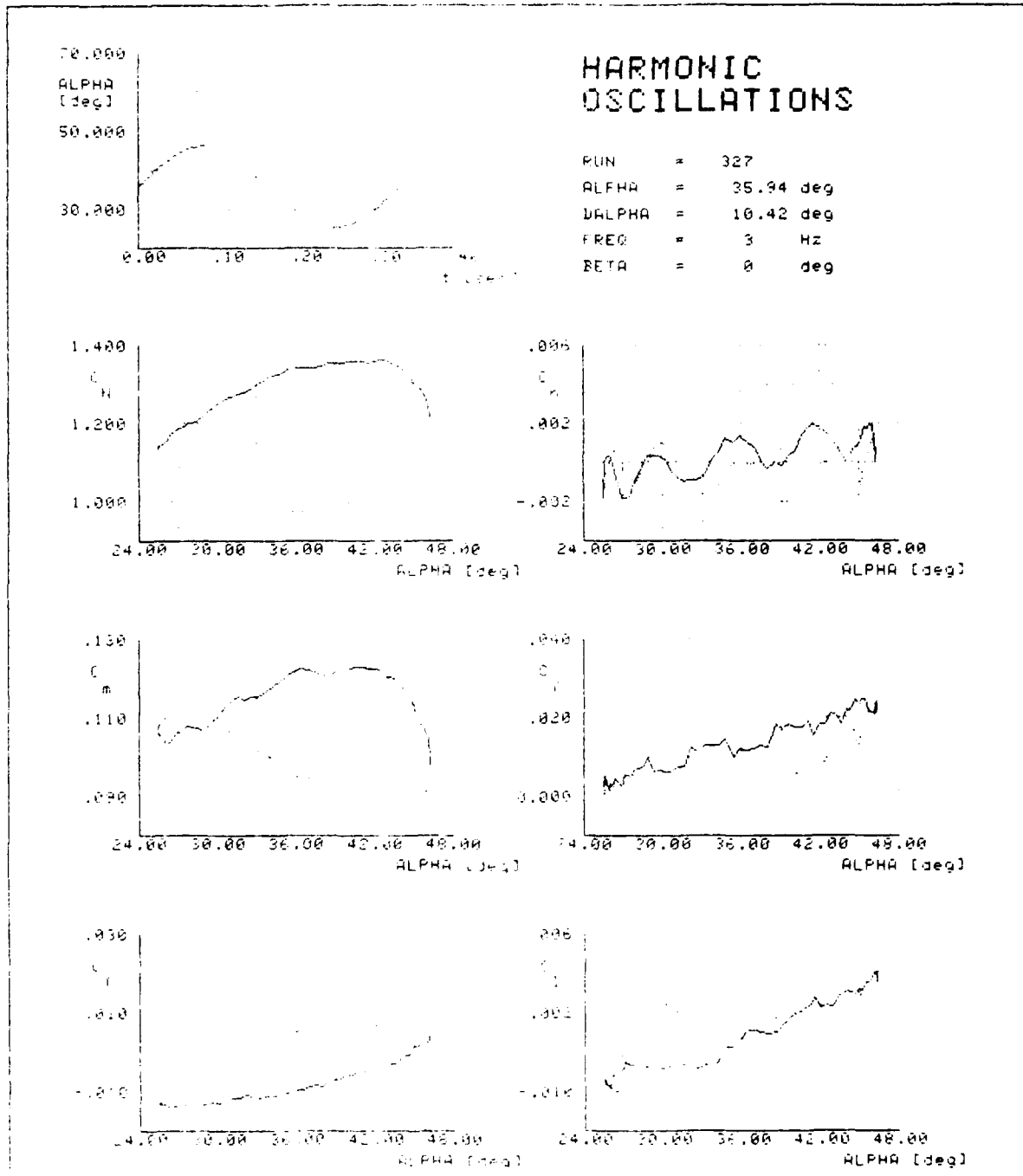


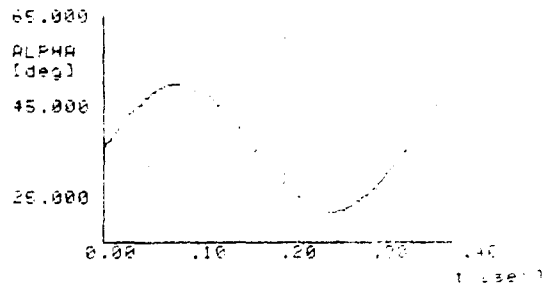


# HARMONIC OSCILLATIONS

$\omega_N$  = 305  
 $\alpha_{LPHR}$  = 35.94 deg  
 $\Delta\alpha_{LPHR}$  = 6.90 deg  
 $\omega_{PO}$  = 3 Hz  
 $\beta_{LPHR}$  = 0 deg

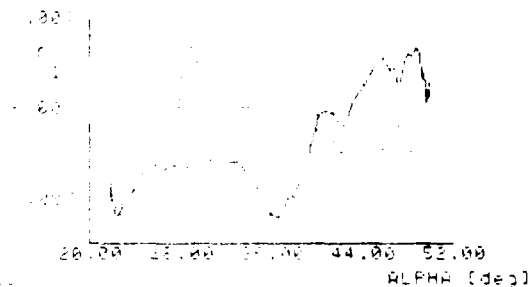
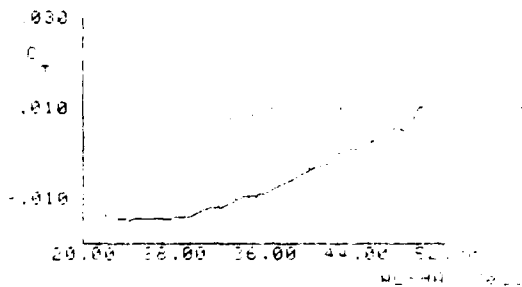
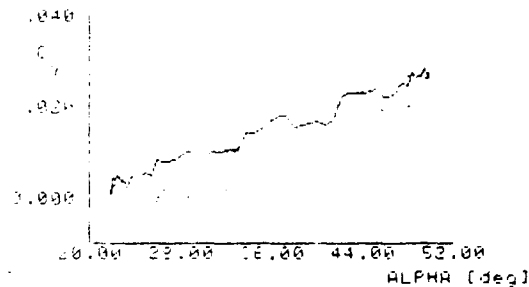
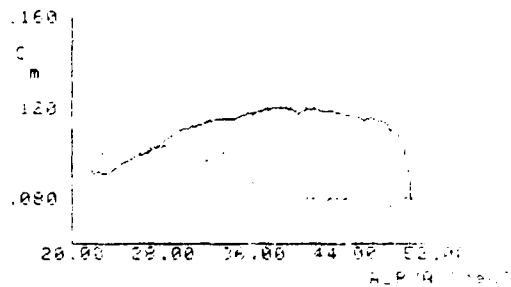
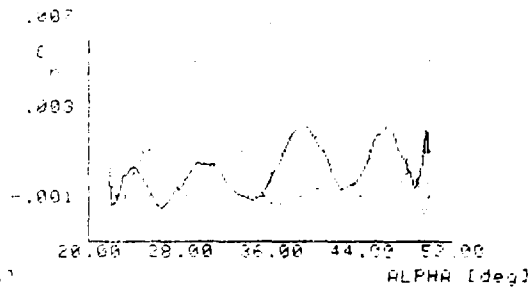
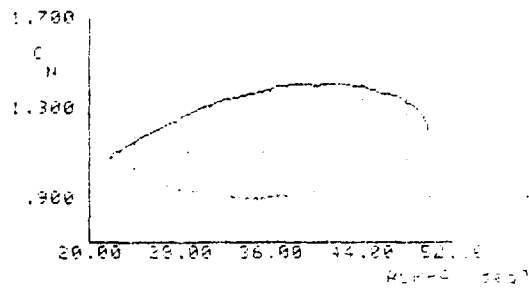


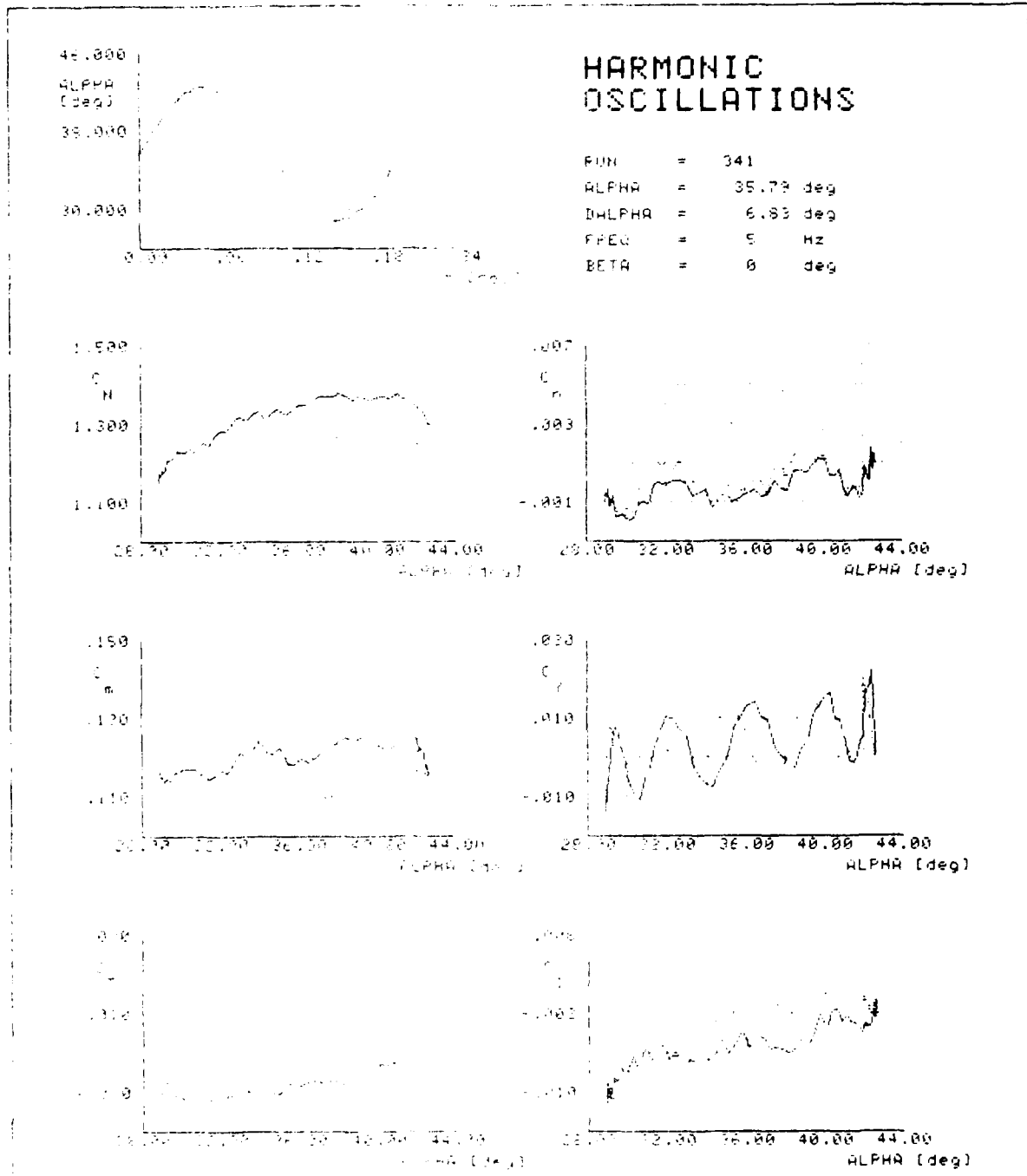


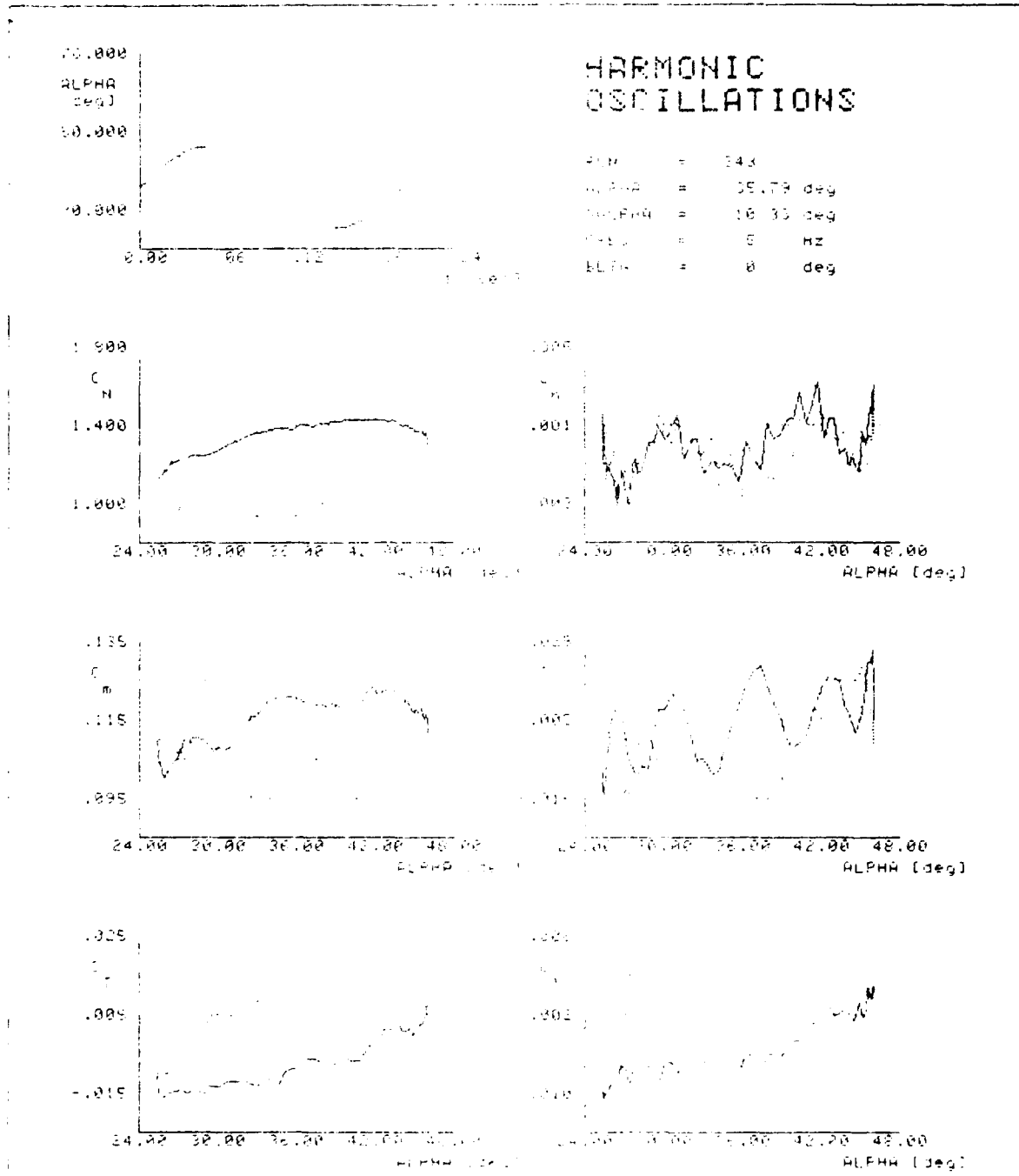


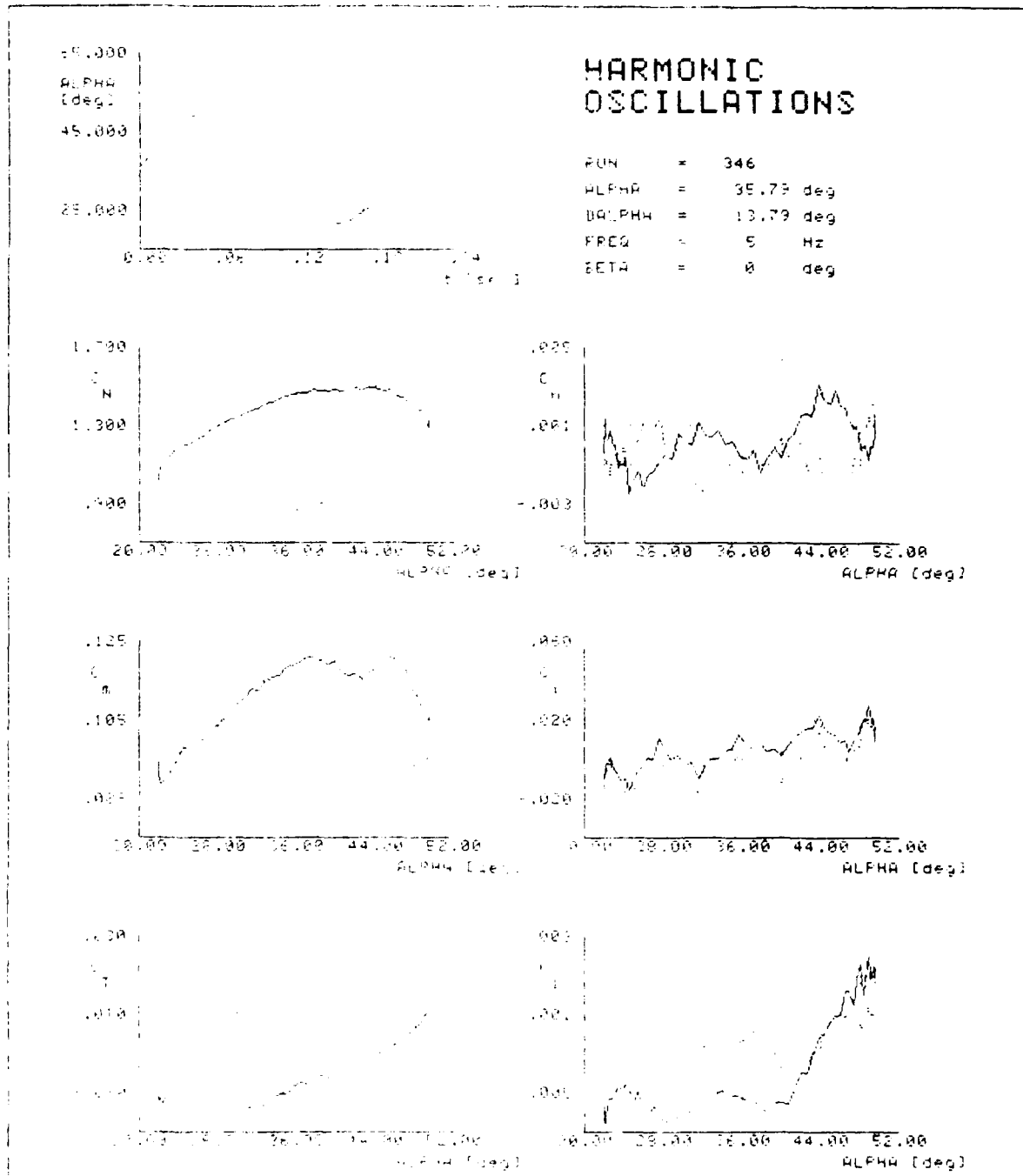
# HARMONIC OSCILLATIONS

RUN = 329  
 ALPHA = 35.95 deg  
 DIALPHA = 14.02 deg  
 FREQ = 3 Hz  
 PSID = 0 deg









40.000

ALPHA  
[deg]

40.000

40.000

0.00 1.00 2.00 3.00 4.00  
C (cm)

# HARMONIC OSCILLATIONS

SGN = 370  
 CPHA = 37.46 deg  
 LCPH = 7.97 deg  
 FSC = 3 Hz  
 SGN = 0 deg

1.500

C

H

1.300

1.100

0.00 14.00 28.00 42.00 46.00  
ALPHA (deg)

1.000

C

H

1.000

1.000

30.00 34.00 38.00 42.00 46.00  
ALPHA (deg)

1.150

C

H

1.100

1.050

30.00 34.00 38.00 42.00 46.00  
ALPHA (deg)

1.012

C

H

1.004

1.004

30.00 34.00 38.00 42.00 46.00  
ALPHA (deg)

1.012

C

H

1.004

1.004

30.00 34.00 38.00 42.00 46.00  
ALPHA (deg)

1.000

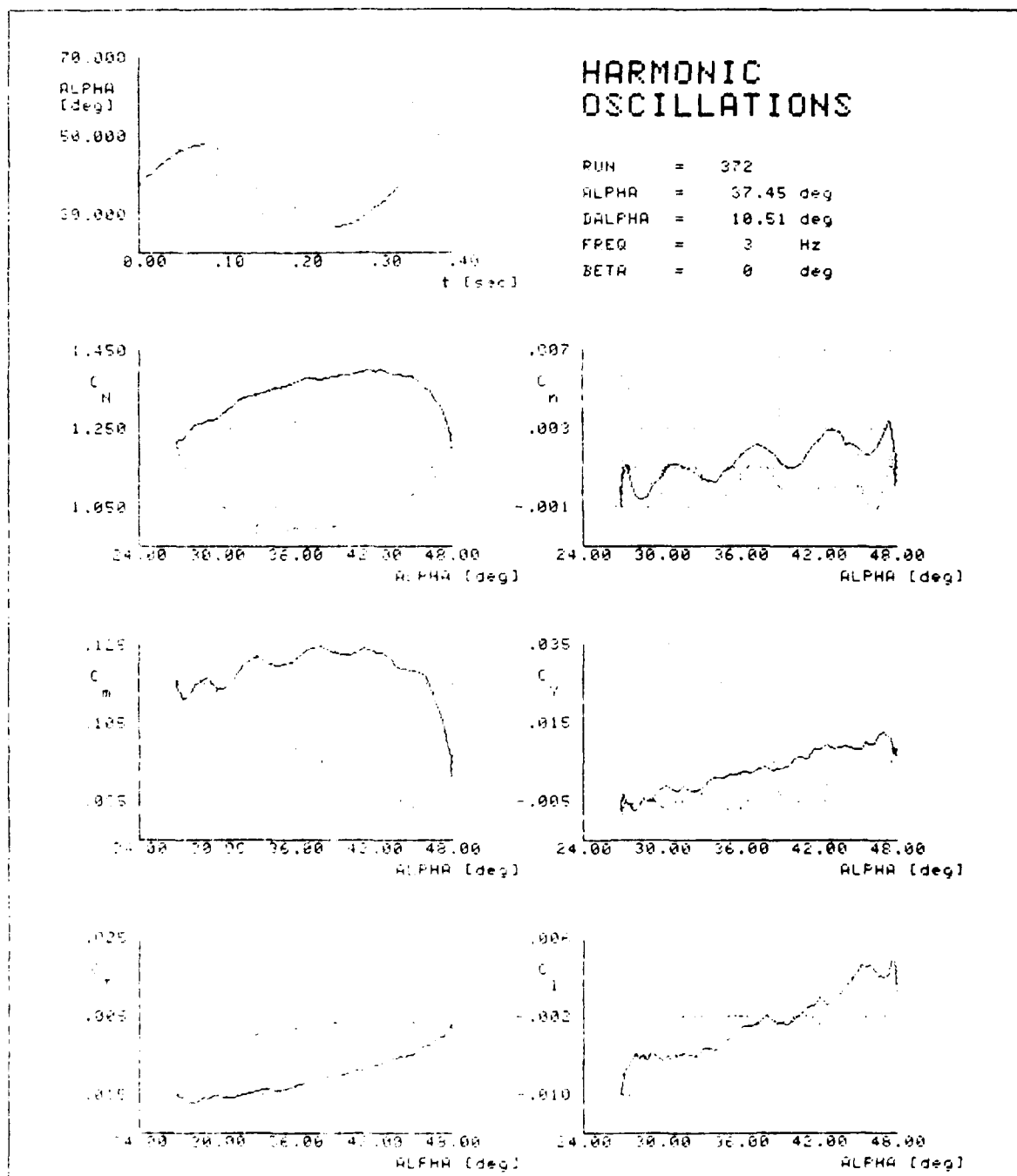
C

H

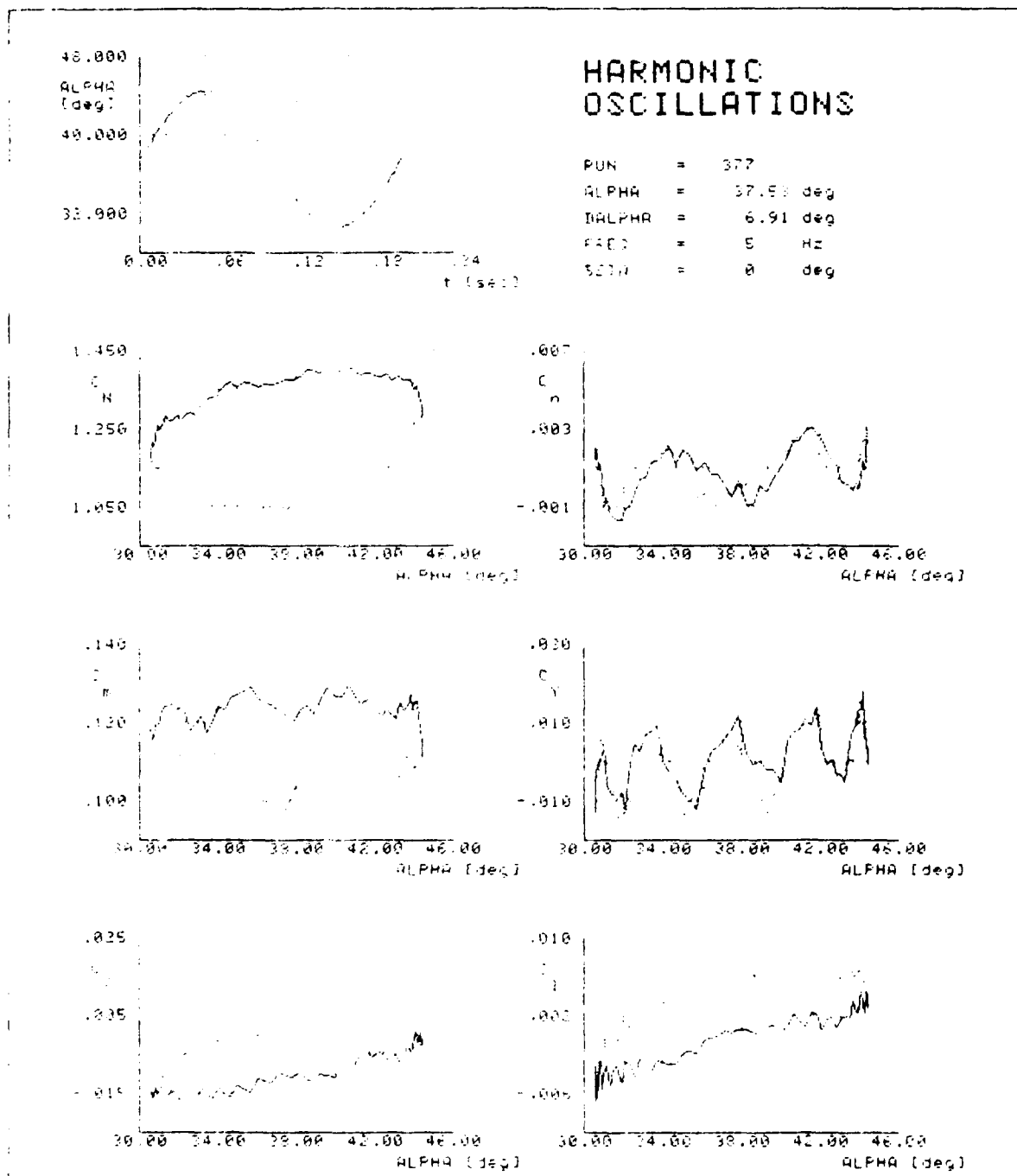
1.000

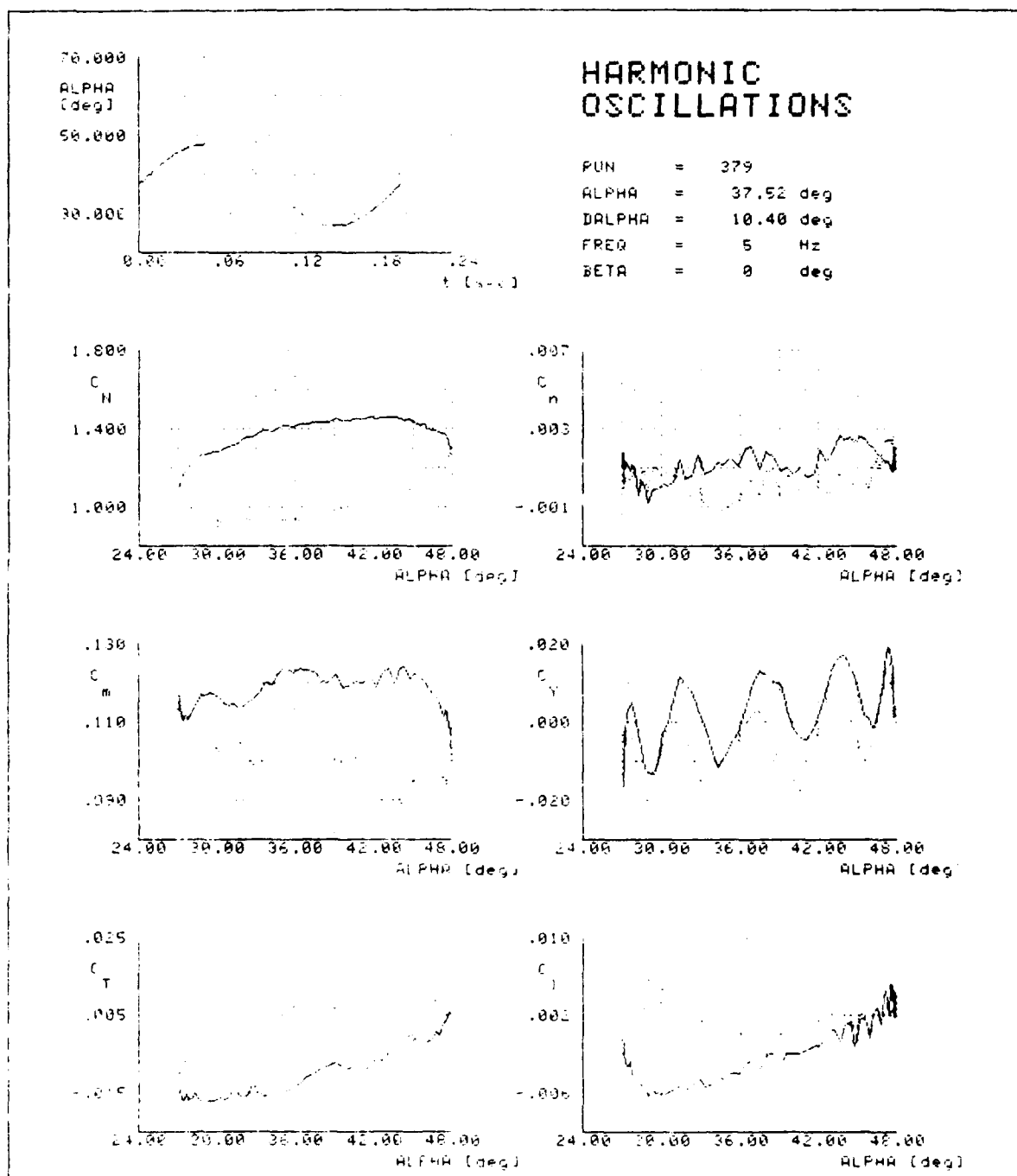
1.000

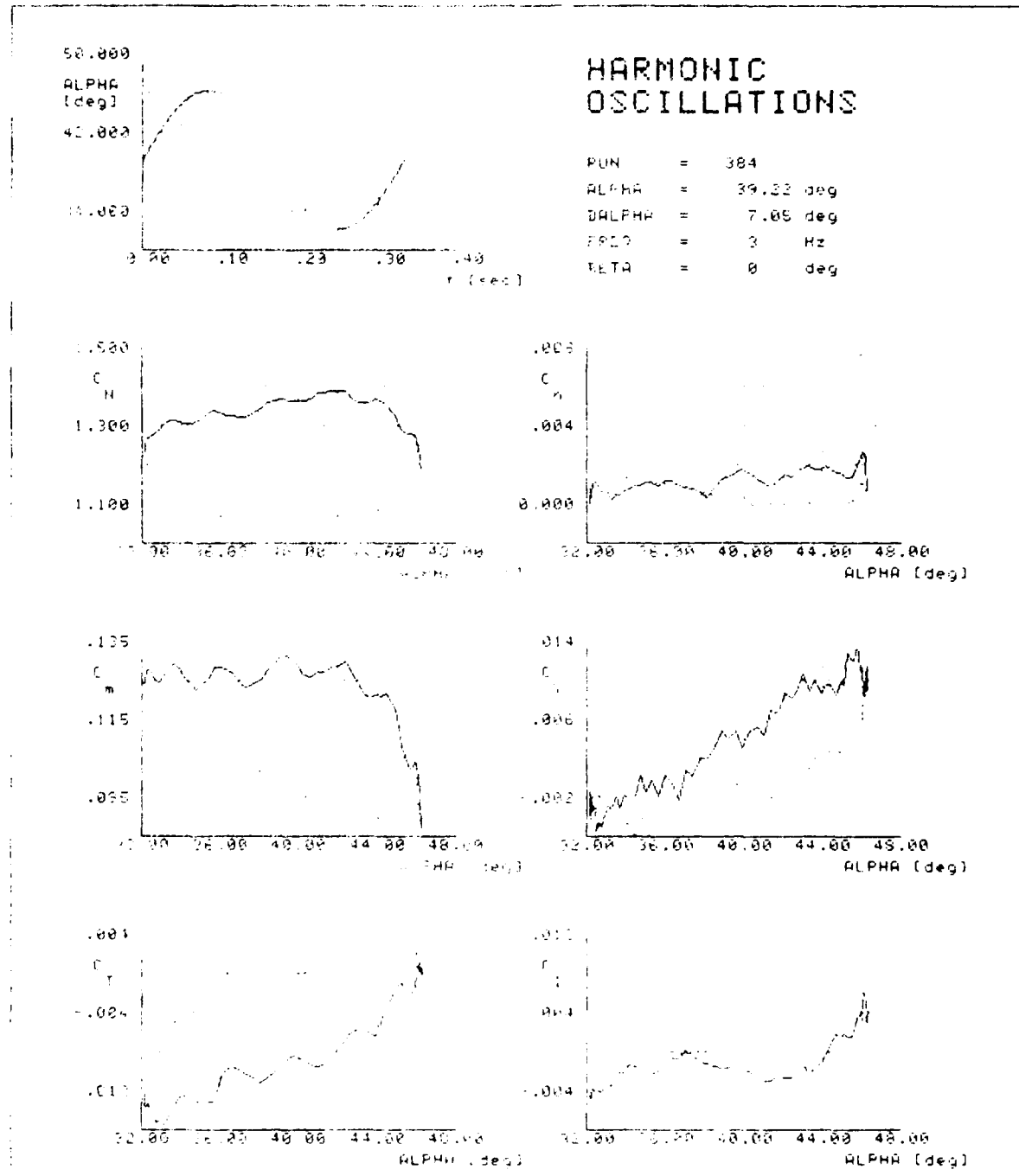
30.00 34.00 38.00 42.00 46.00  
ALPHA (deg)

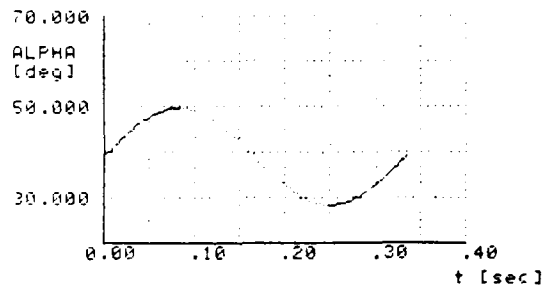






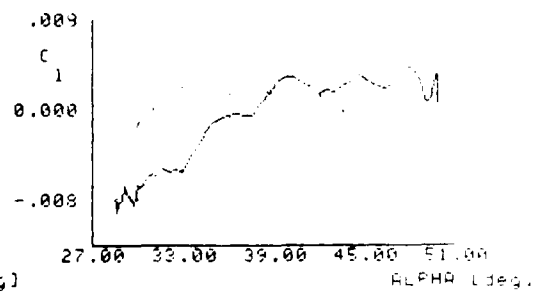
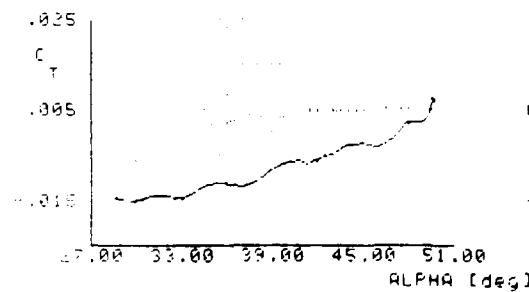
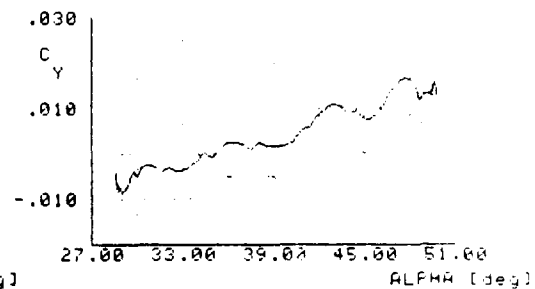
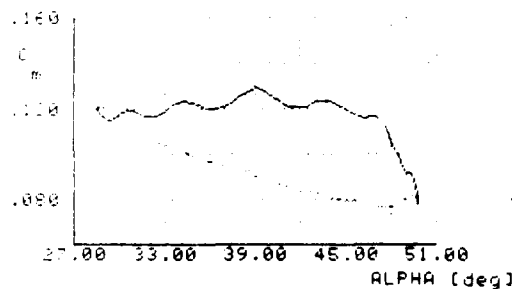
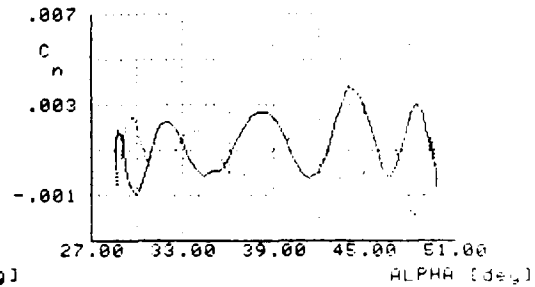
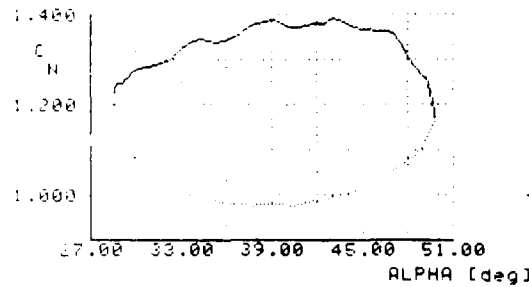




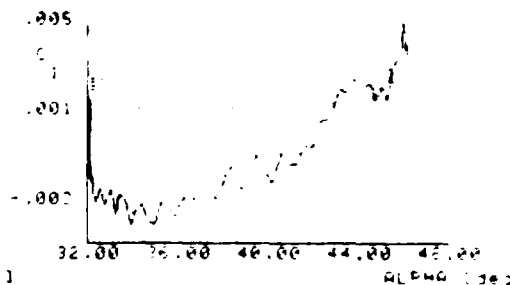
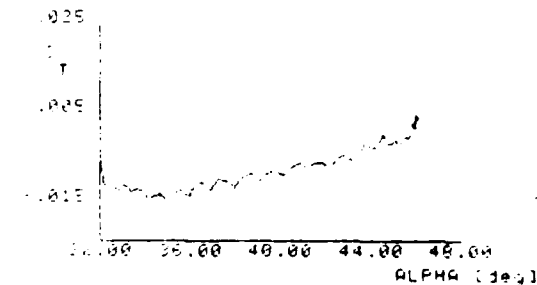
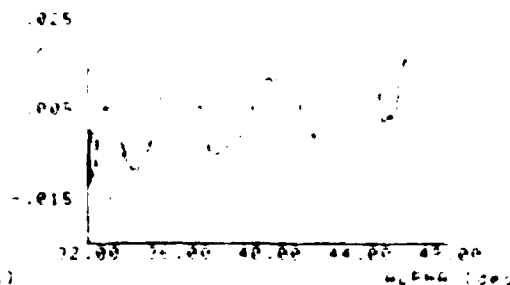
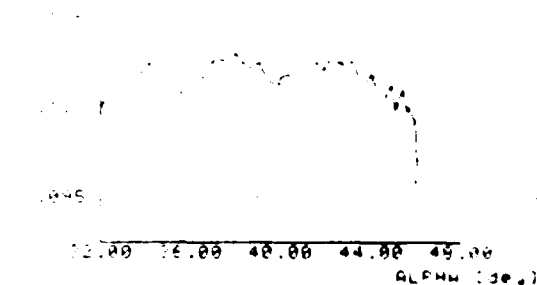
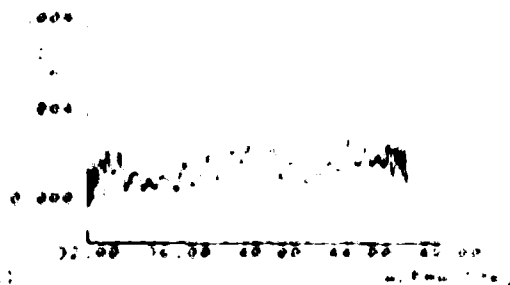
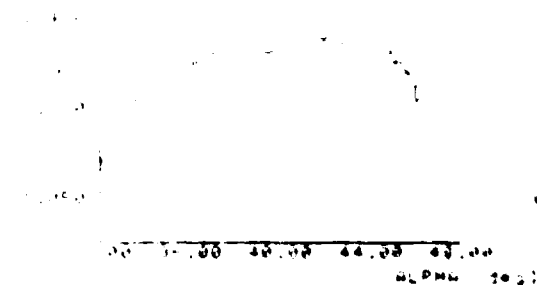
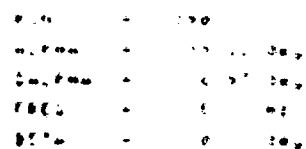
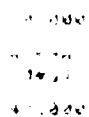


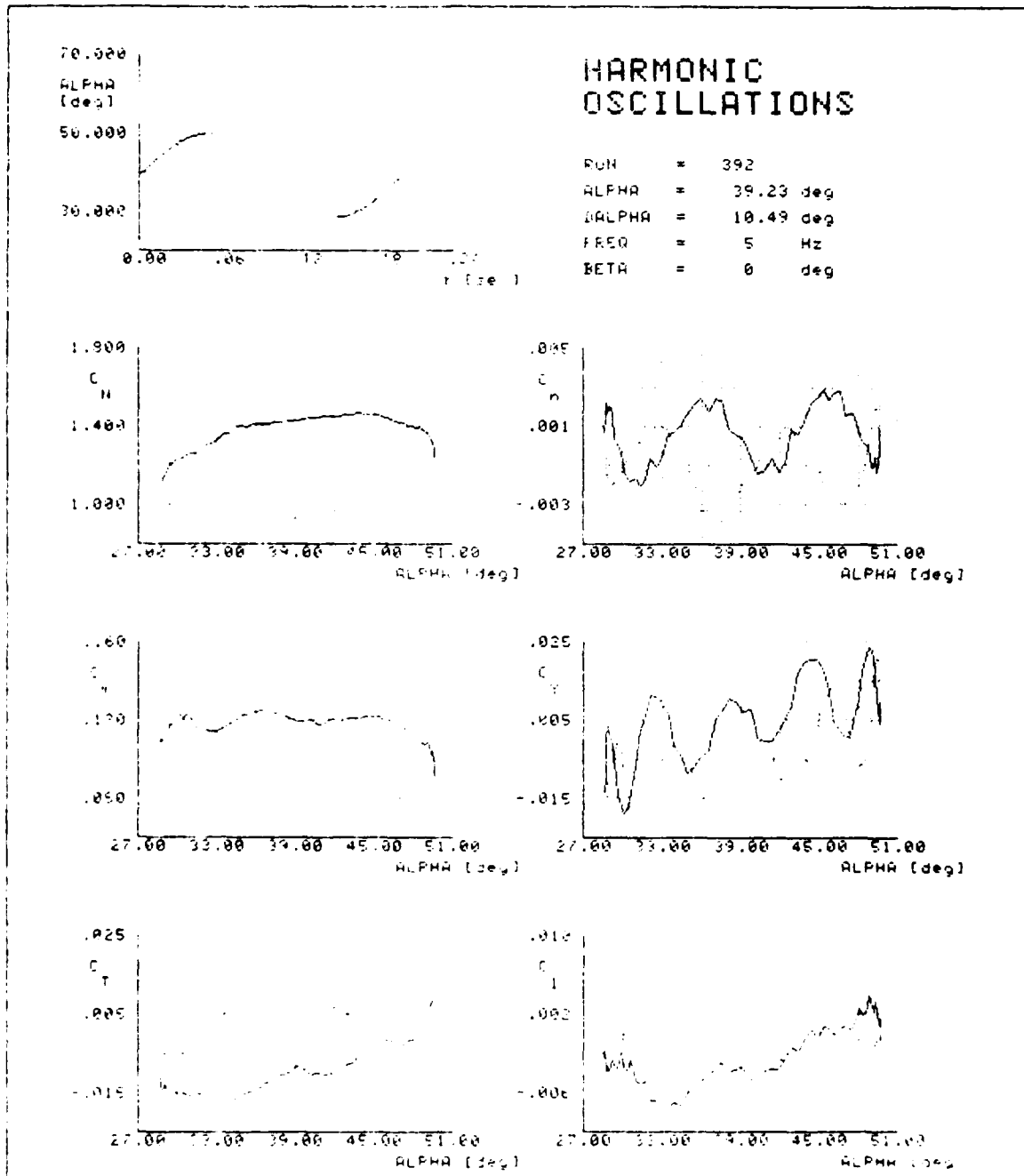
# HARMONIC OSCILLATIONS

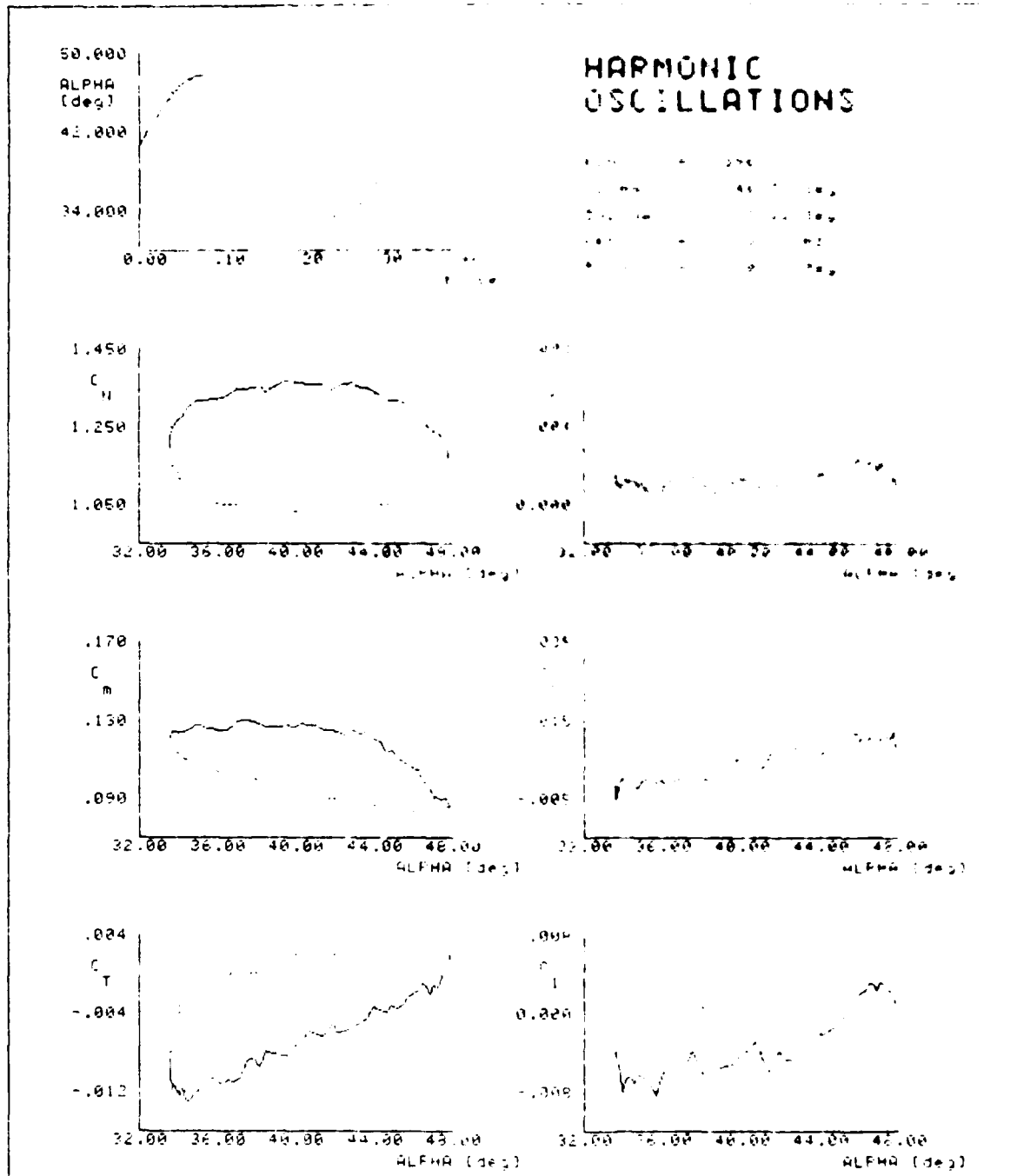
RUN = 386  
ALPHA = 39.23 deg  
DALPHA = 10.59 deg  
FREQ = 3 Hz  
BETA = 0 deg

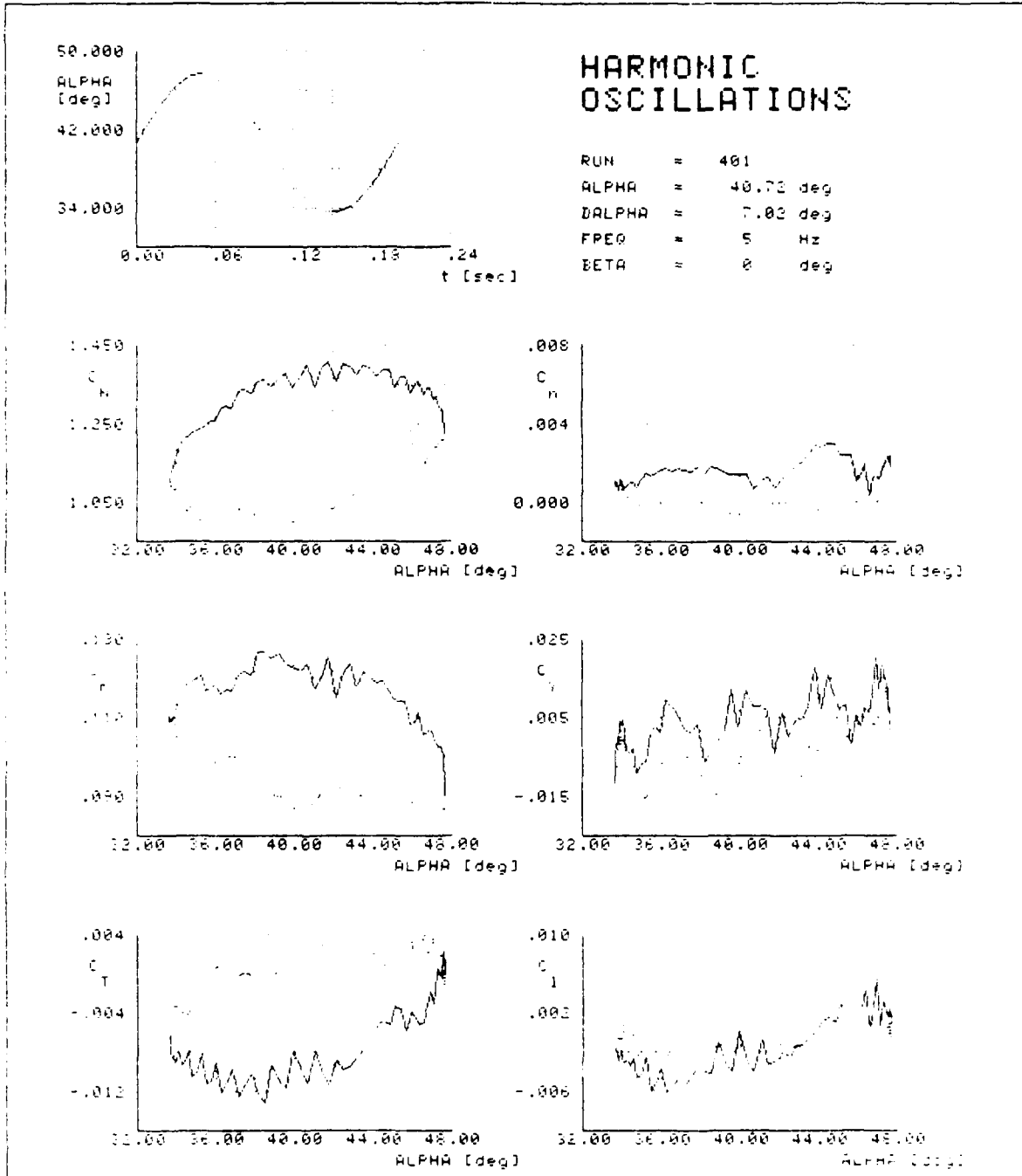


## HARMONIC OSCILLATIONS











52.000

ALPHA

(deg)

44.000

36.000

28.000

20.000

12.000

4.000

0.000

-8.000

-16.000

-24.000

-32.000

-40.000

-48.000

-56.000

-64.000

-72.000

-80.000

-88.000

-96.000

-104.000

-112.000

-120.000

-128.000

-136.000

-144.000

-152.000

-160.000

-168.000

-176.000

-184.000

-192.000

-200.000

-208.000

-216.000

-224.000

-232.000

-240.000

-248.000

-256.000

-264.000

-272.000

-280.000

-288.000

-296.000

-304.000

-312.000

-320.000

-328.000

-336.000

-344.000

-352.000

# HARMONIC OSCILLATIONS

ALPHA = 0.00  
ALPHA = 0.00  
ALPHA = 0.00  
ALPHA = 0.00  
ALPHA = 0.00  
ALPHA = 0.00

1.450

1.400

1.350

1.300

1.250

1.200

1.150

1.100

1.050

1.000

0.950

0.900

0.850

0.800

0.750

0.700

0.650

0.600

0.550

0.500

0.450

0.400

0.350

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0.250

0.200

0.150

0.100

0.050

0.000

-0.050

-0.100

-0.150

-0.200

-0.250

-0.300

-0.350

-0.400

-0.450

-0.500

-0.550

-0.600

-0.650

-0.700

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0.00

1.000

0.950

0.900

0.850

0.800

0.750

0.700

0.650

0.600

0.550

0.500

0.450

0.400

0.350

0.300

0.250

0.200

0.150

0.100

0.050

0.000

-0.050

0.00

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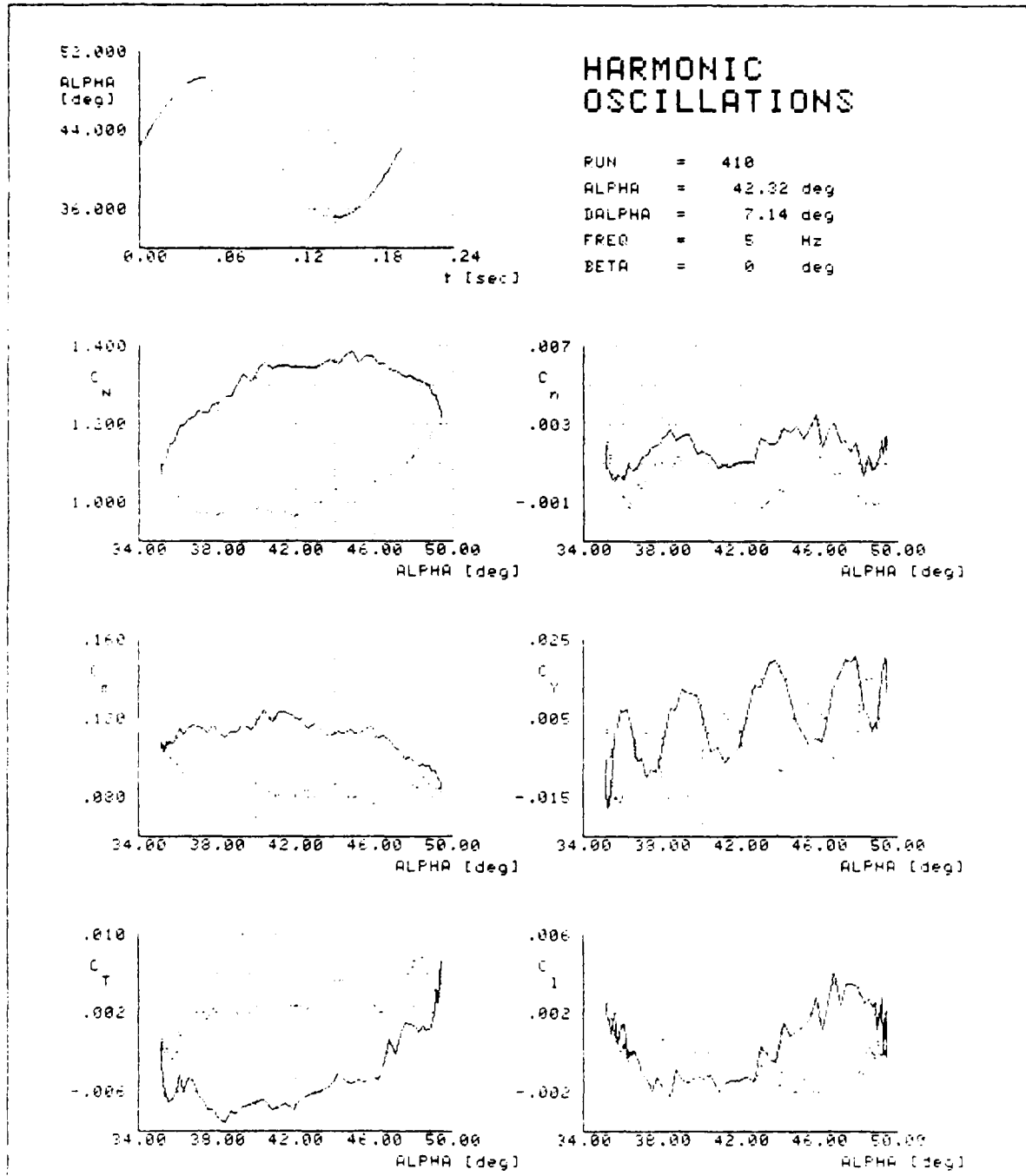
0.00

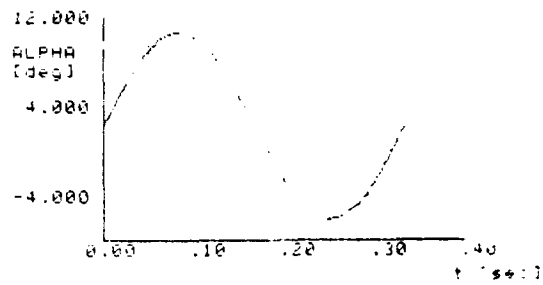
0.00

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0.00

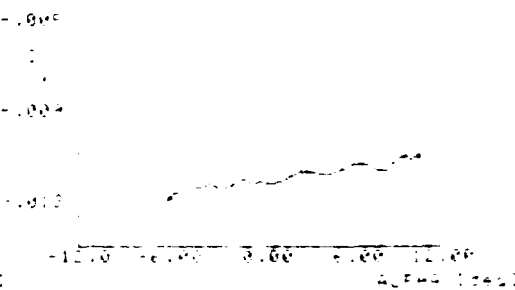
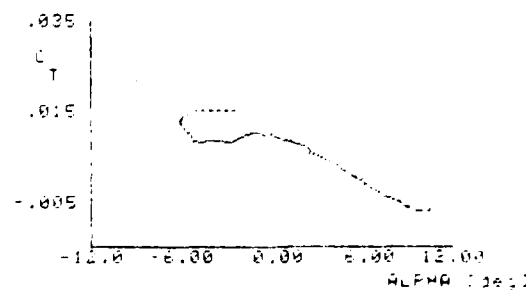
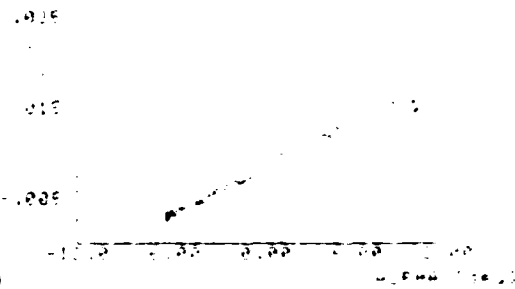
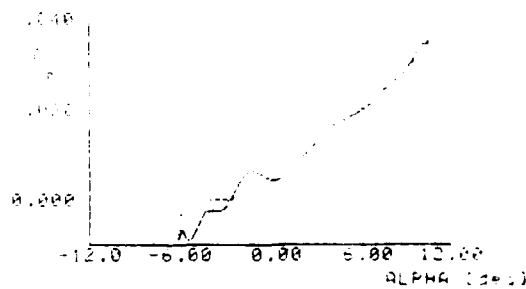
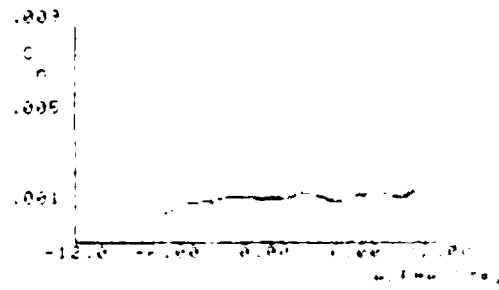
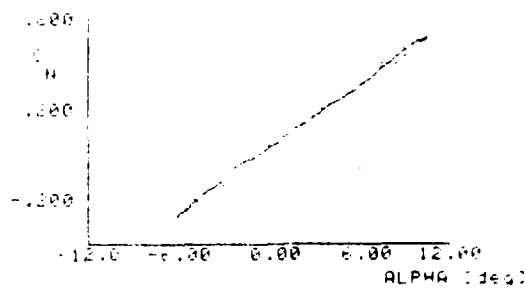
0.00

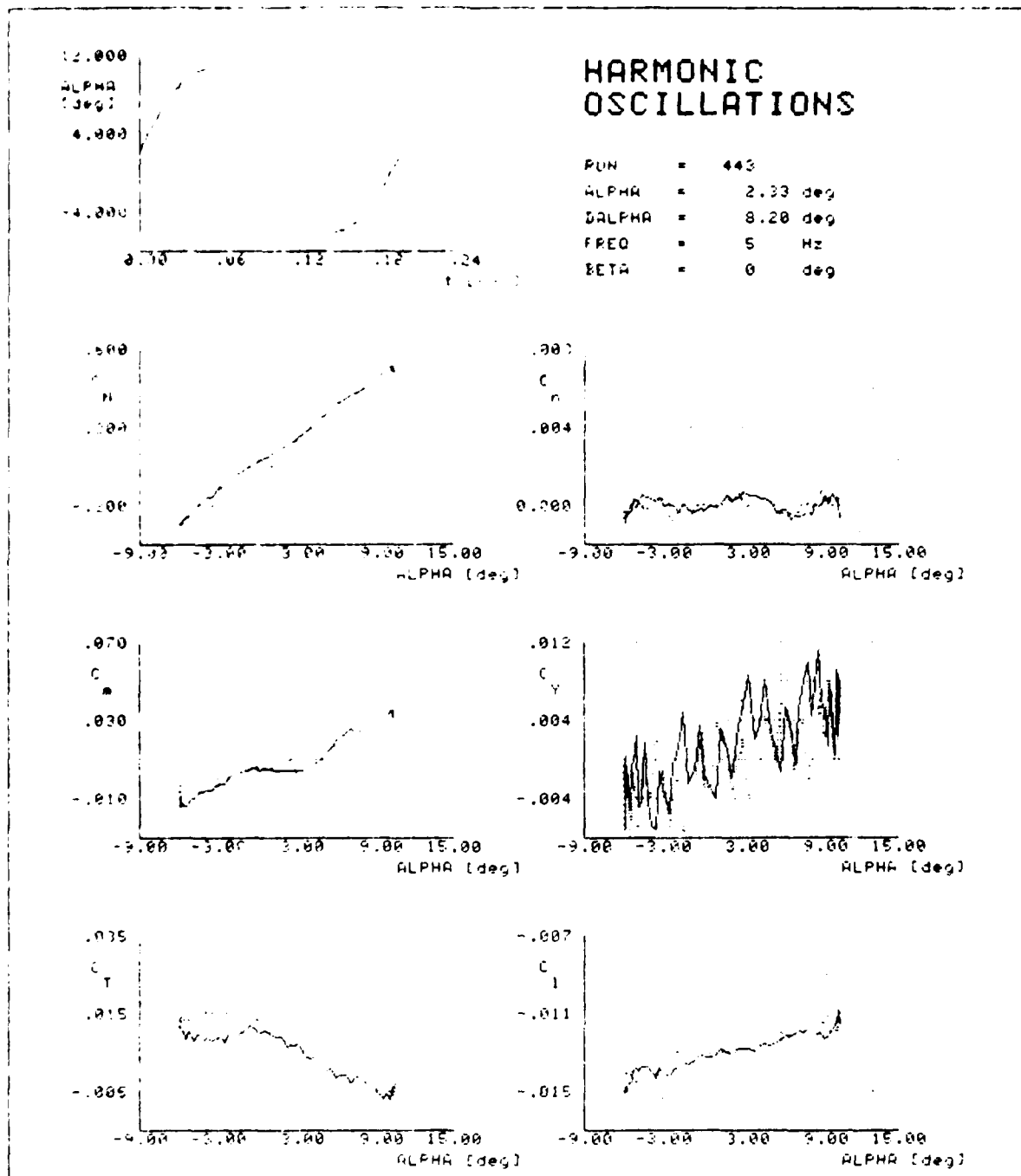


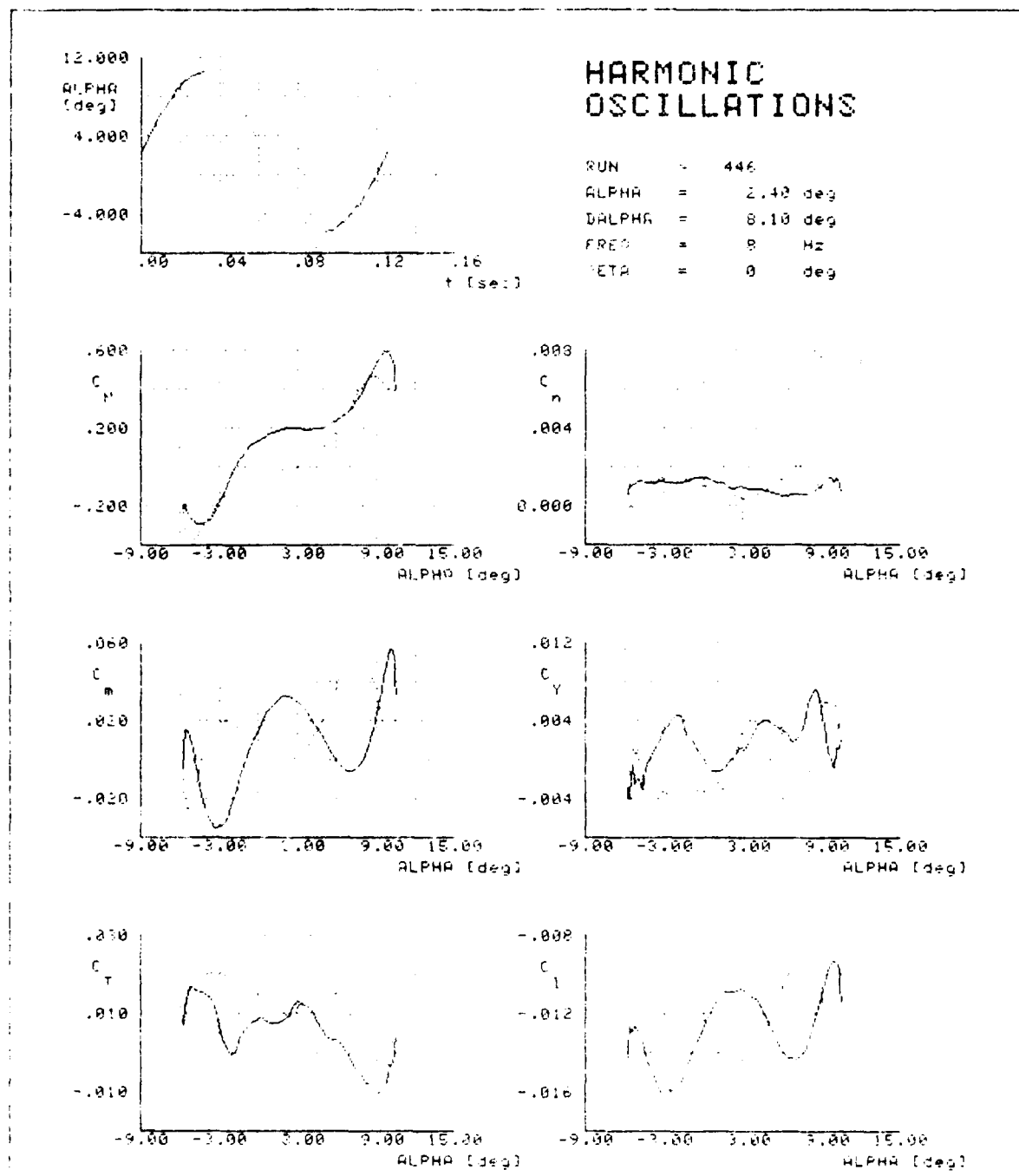


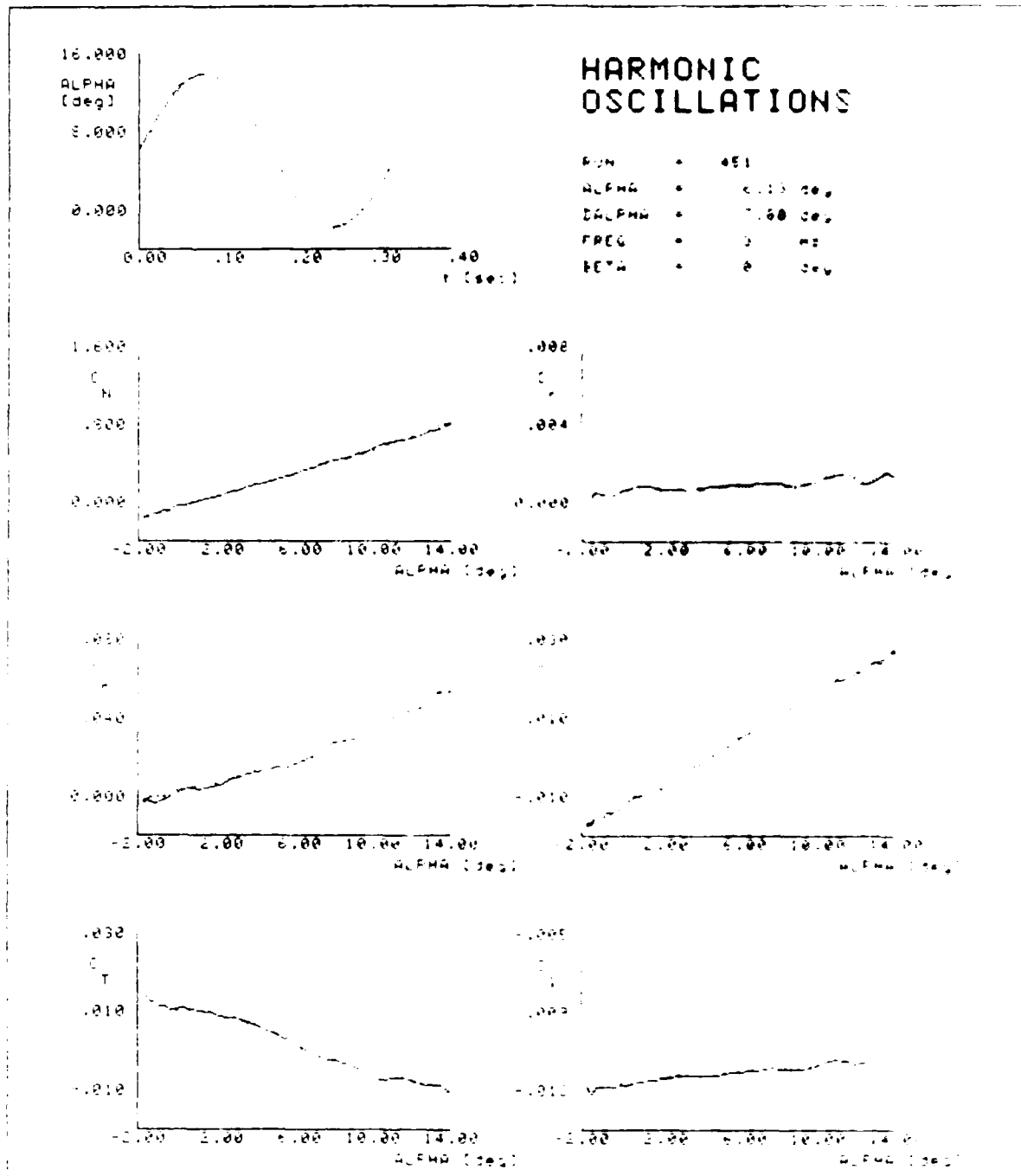
# HARMONIC OSCILLATIONS

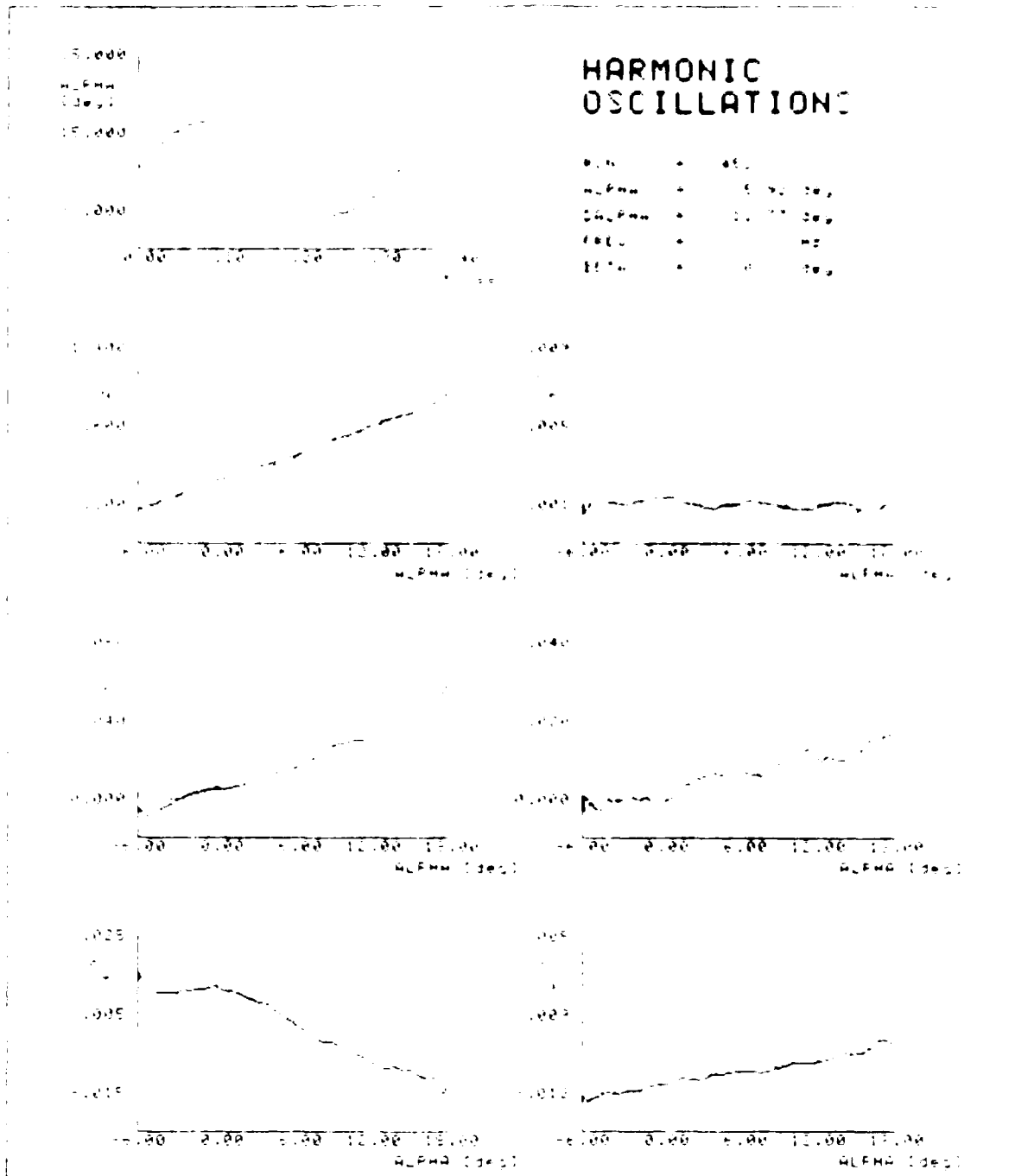
RUN = 440  
ALPHA = 1.57 deg  
DALPHA = 0.111 deg  
FREQ = 0 Hz  
BETA = 1.57 deg

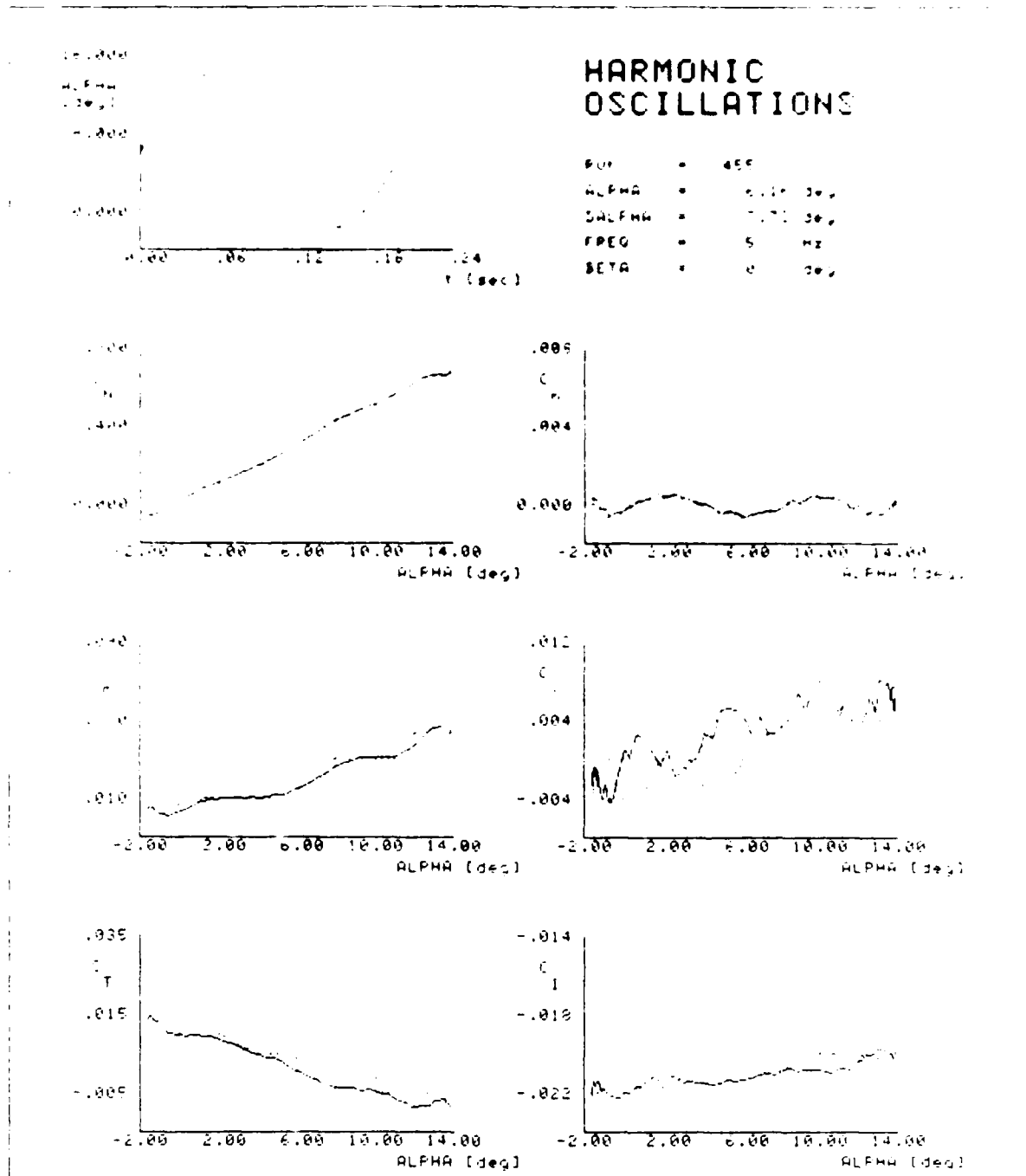




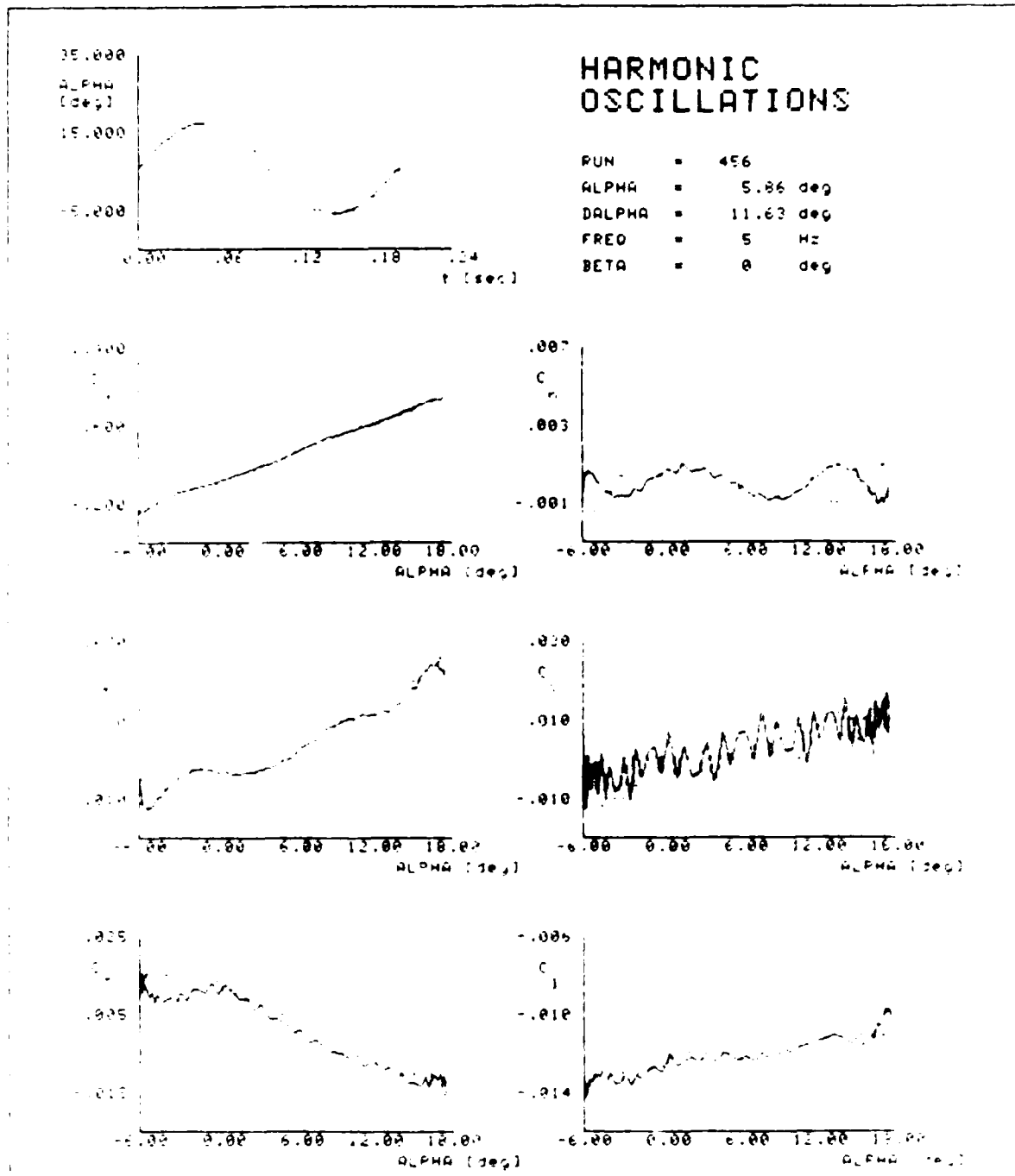


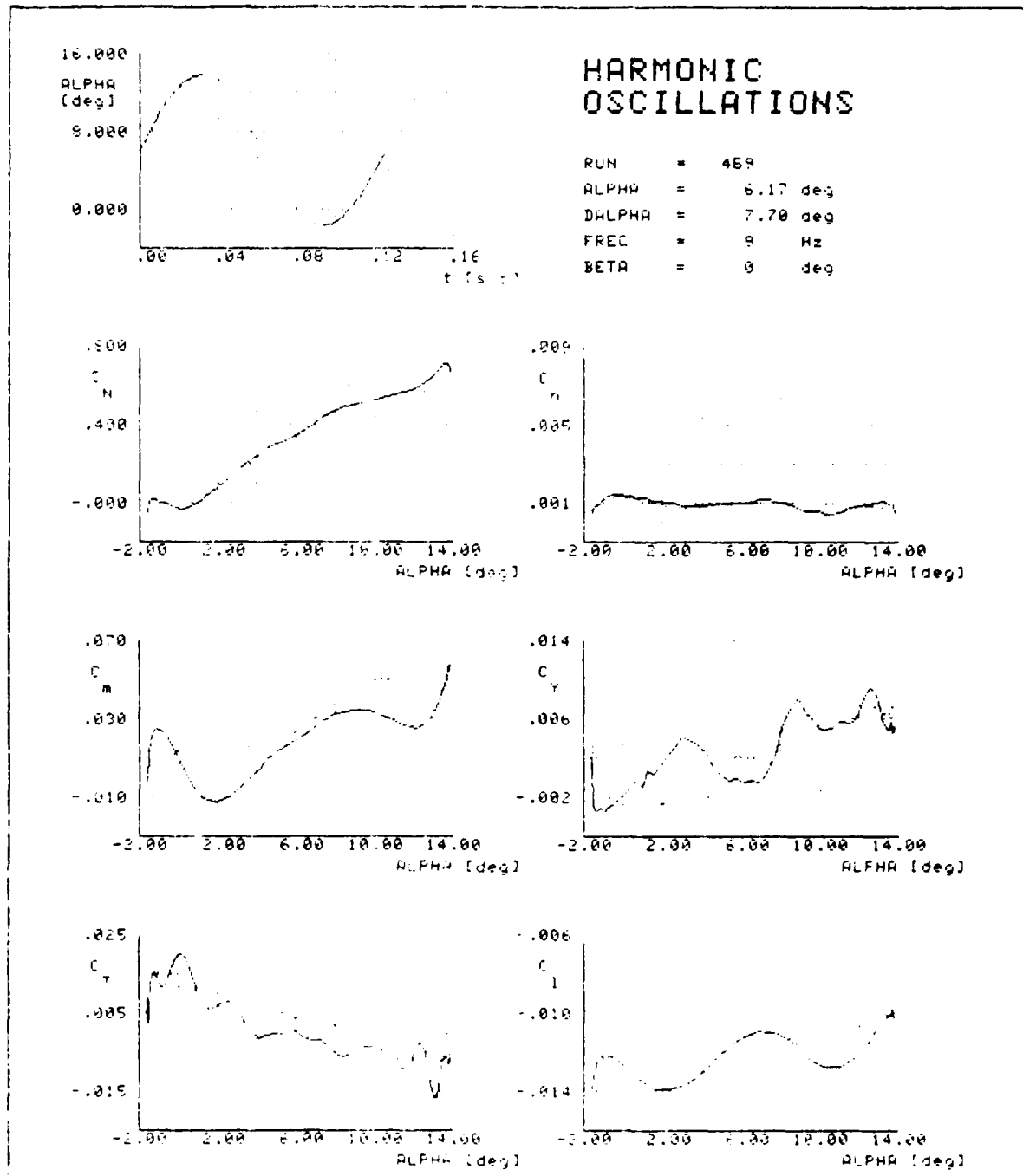


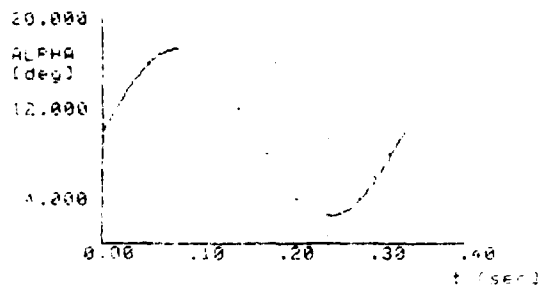






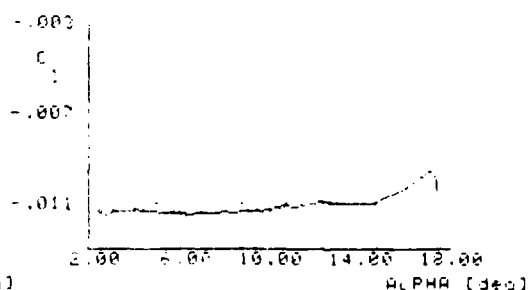
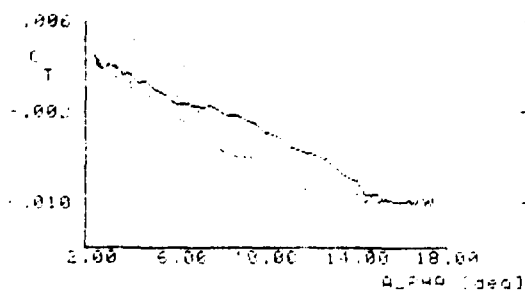
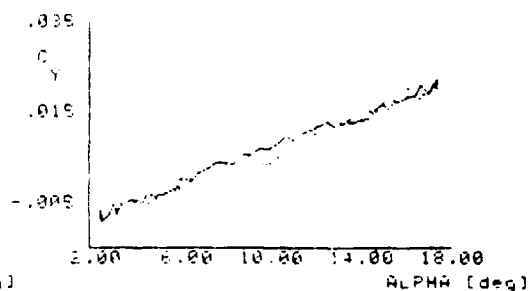
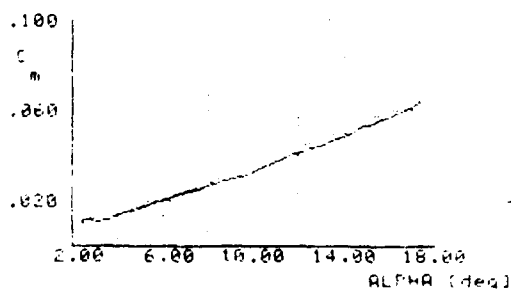
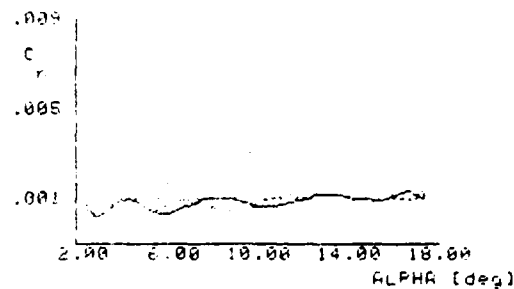
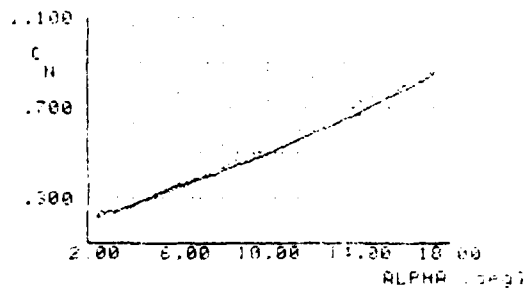


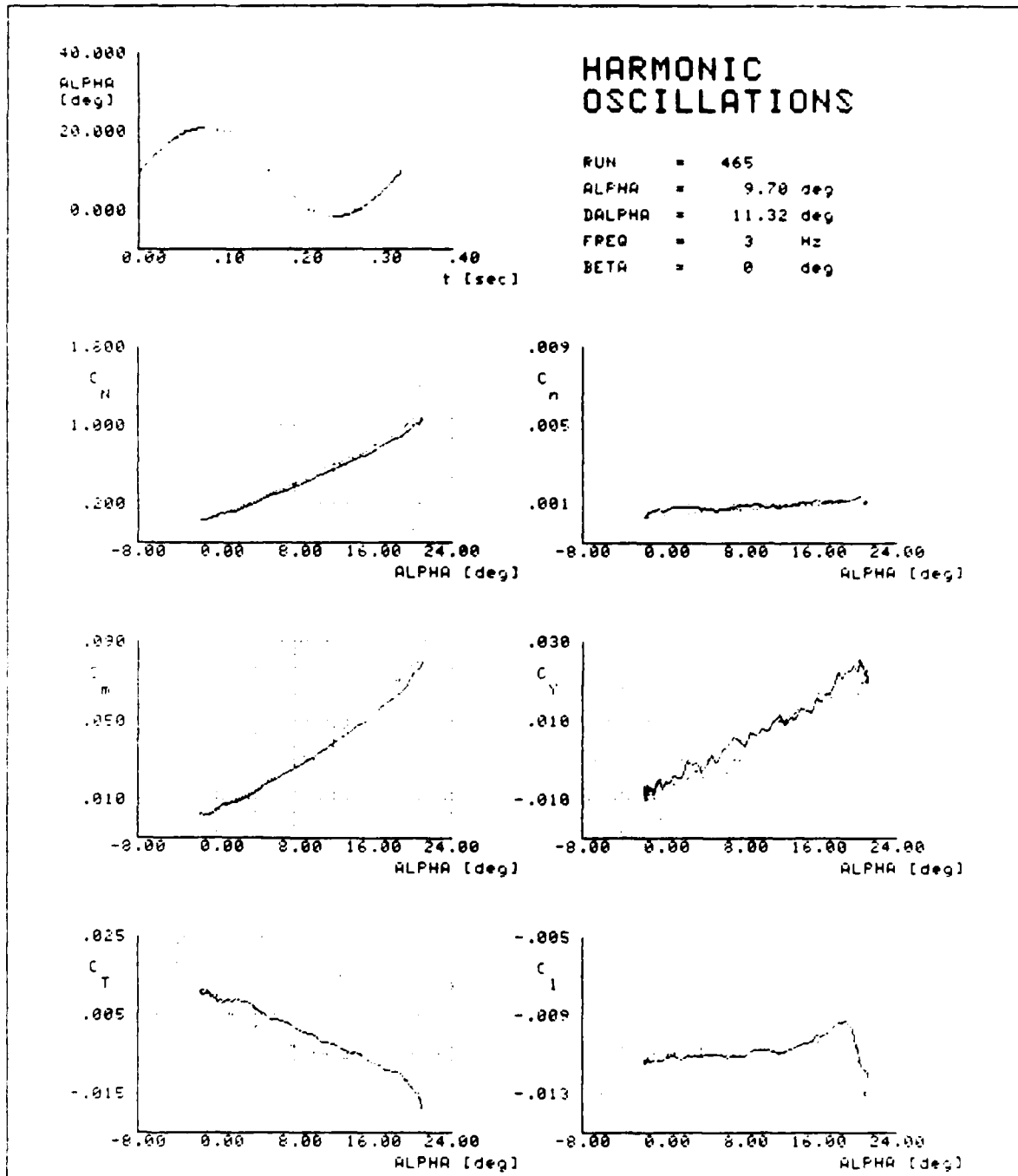


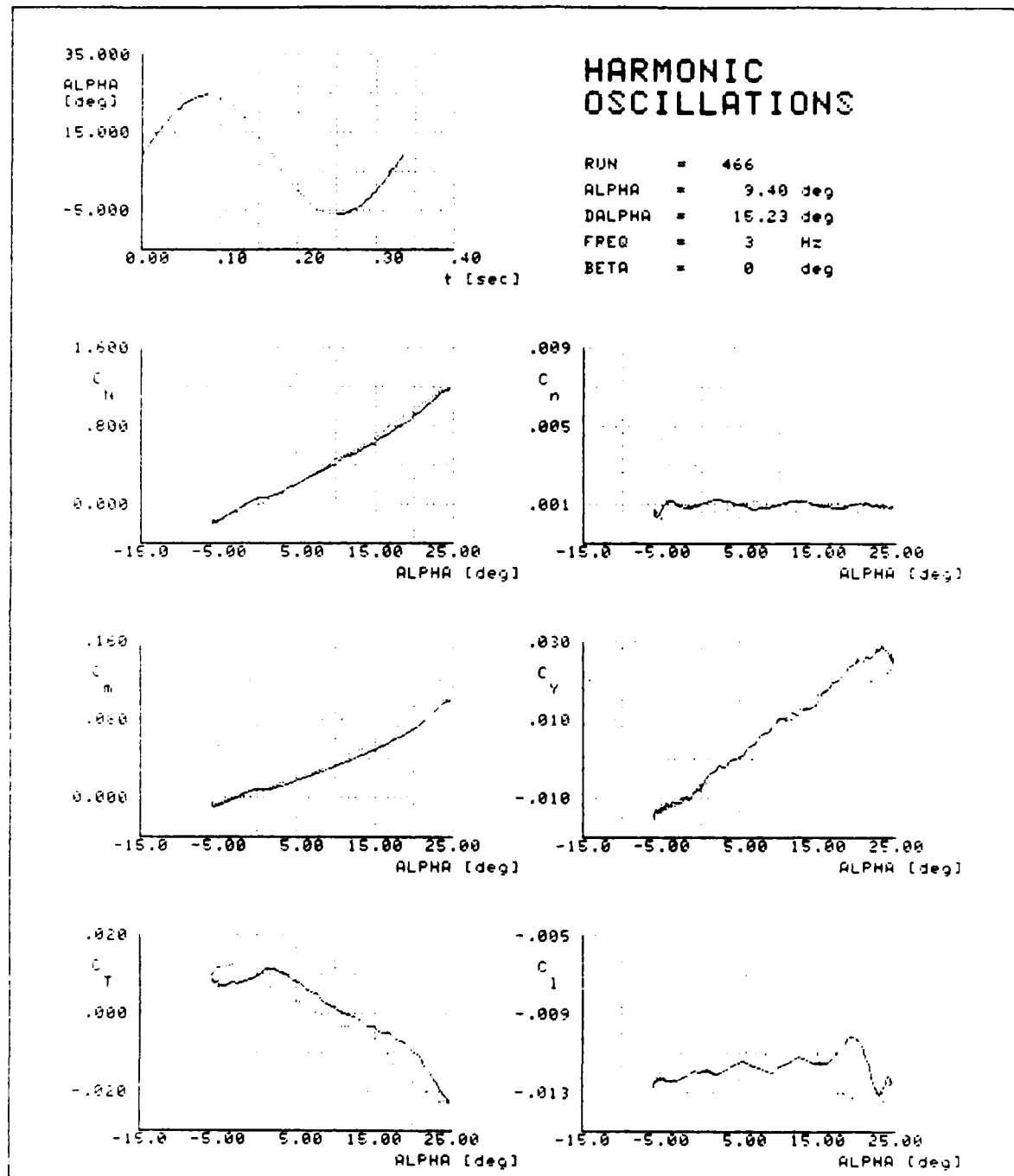


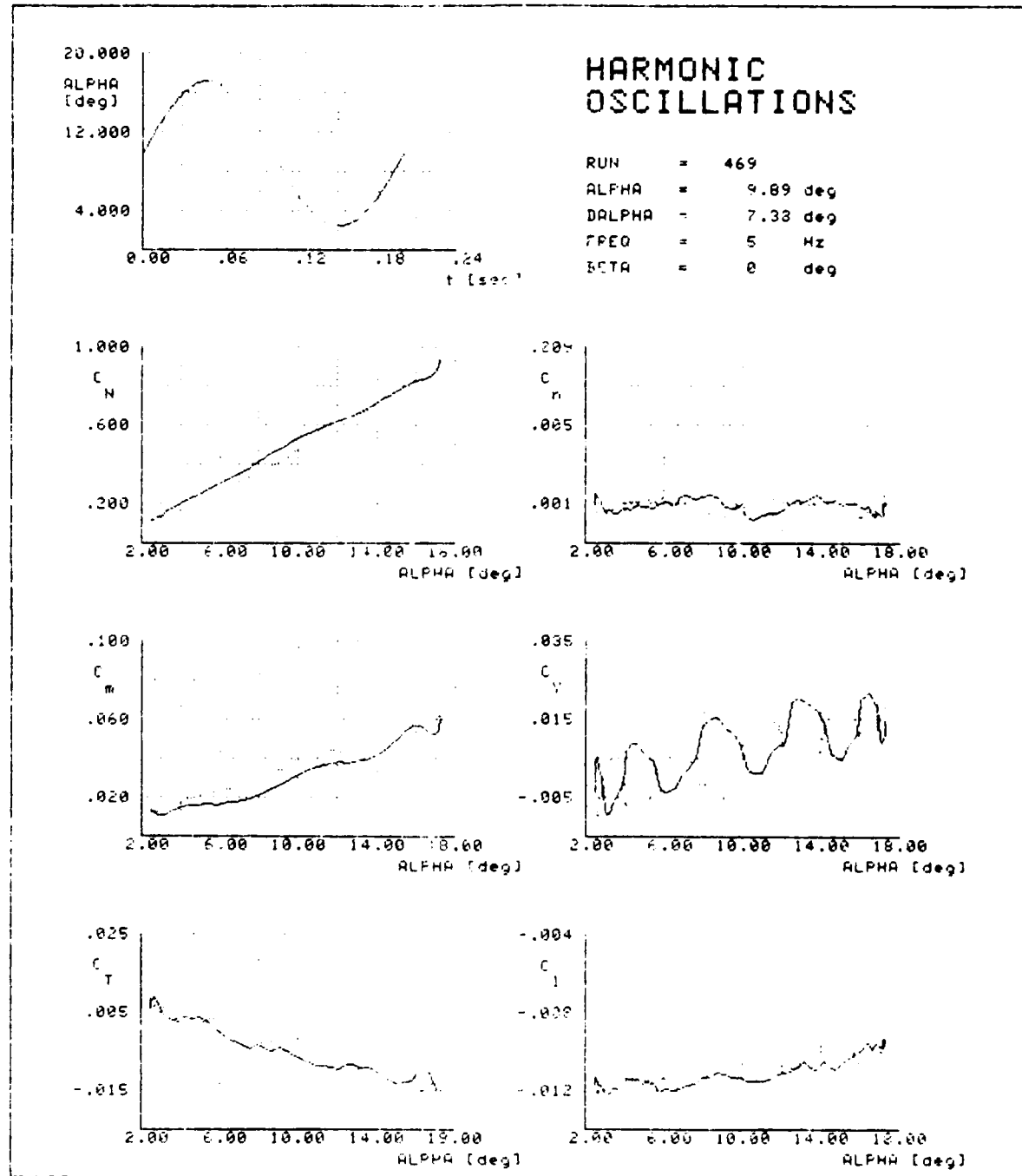
# HARMONIC OSCILLATIONS

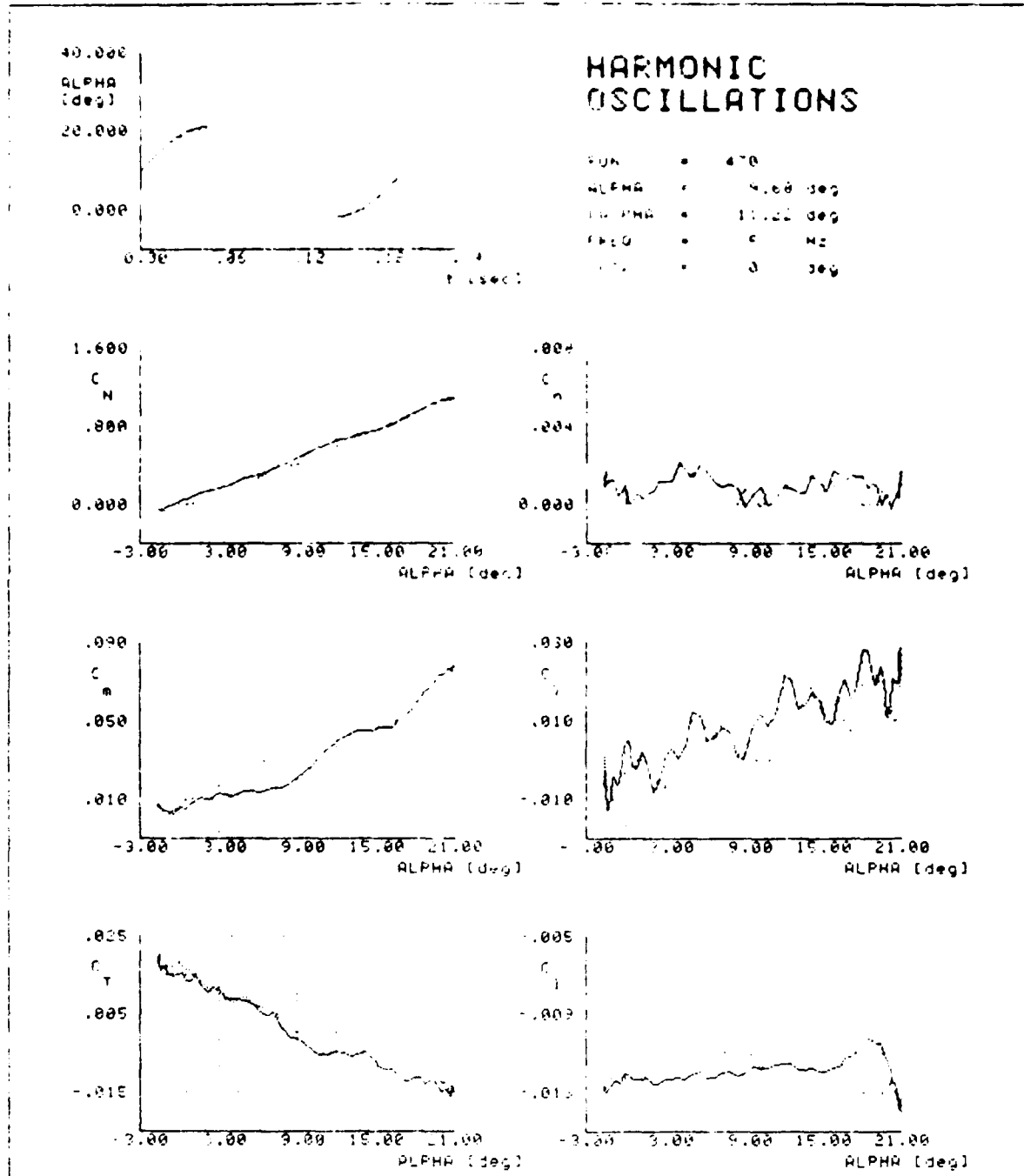
$\omega_N = 464$   
 $\alpha = 9.95 \text{ deg}$   
 $\beta\alpha = 7.46 \text{ deg}$   
 $\omega = 3 \text{ Hz}$   
 $\gamma = 0 \text{ deg}$

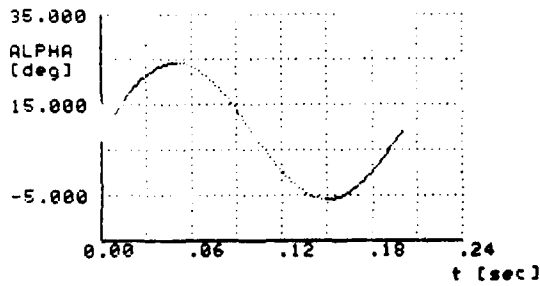






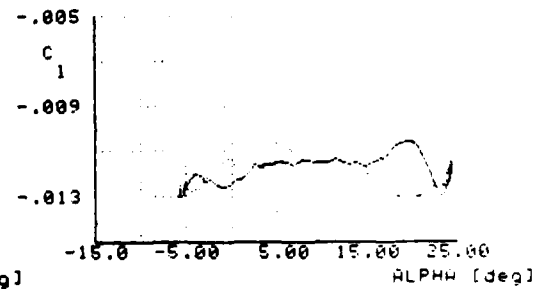
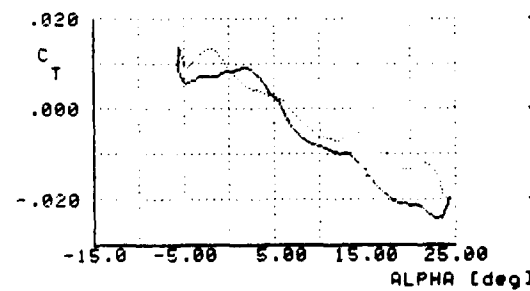
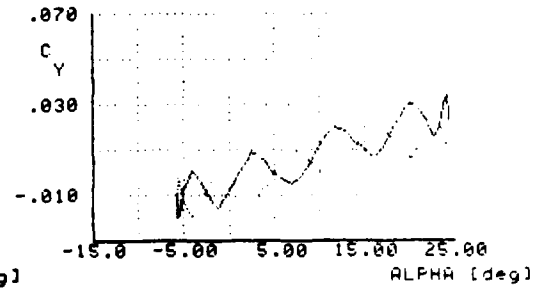
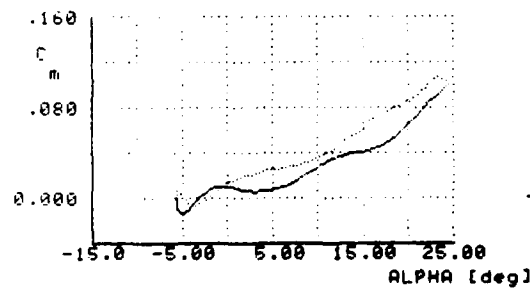
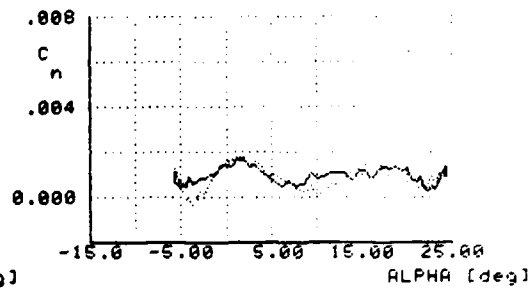
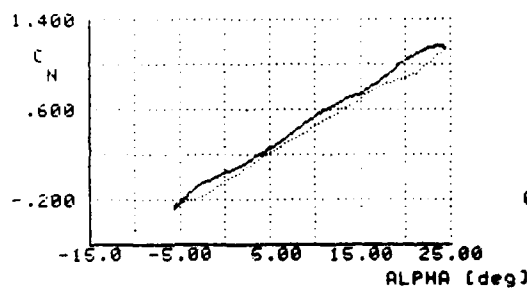




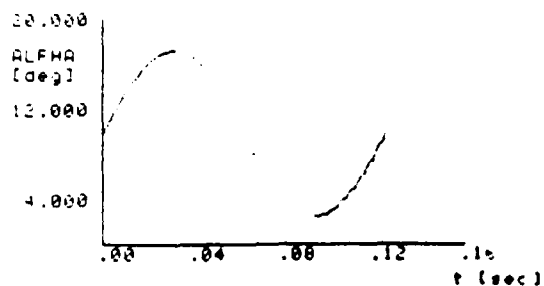


## HARMONIC OSCILLATIONS

RUN = 471  
 ALPHA = 9.42 deg  
 DALPHA = 15.03 deg  
 FREQ = 5 Hz  
 BETA = 0 deg

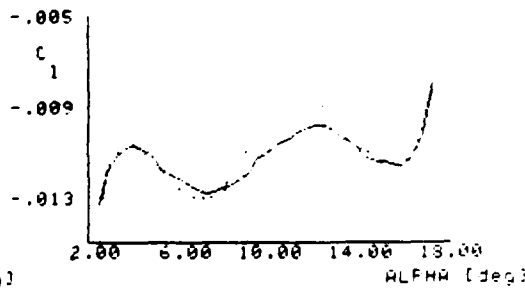
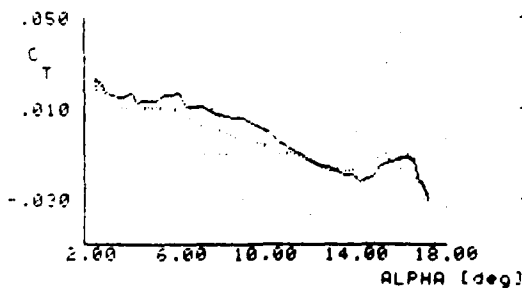
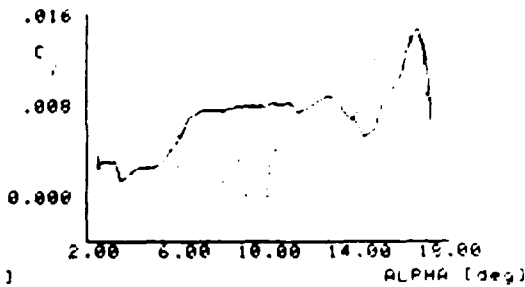
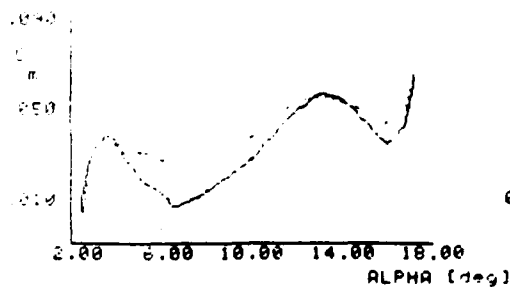
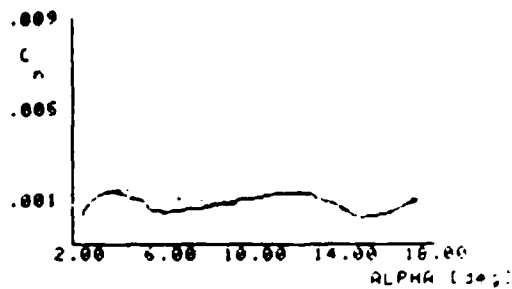
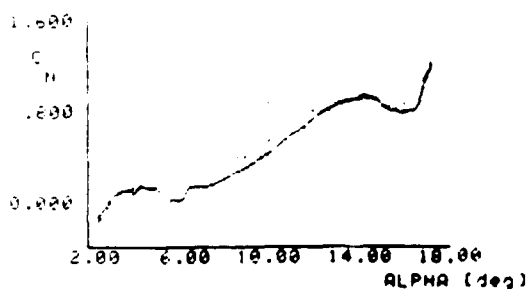


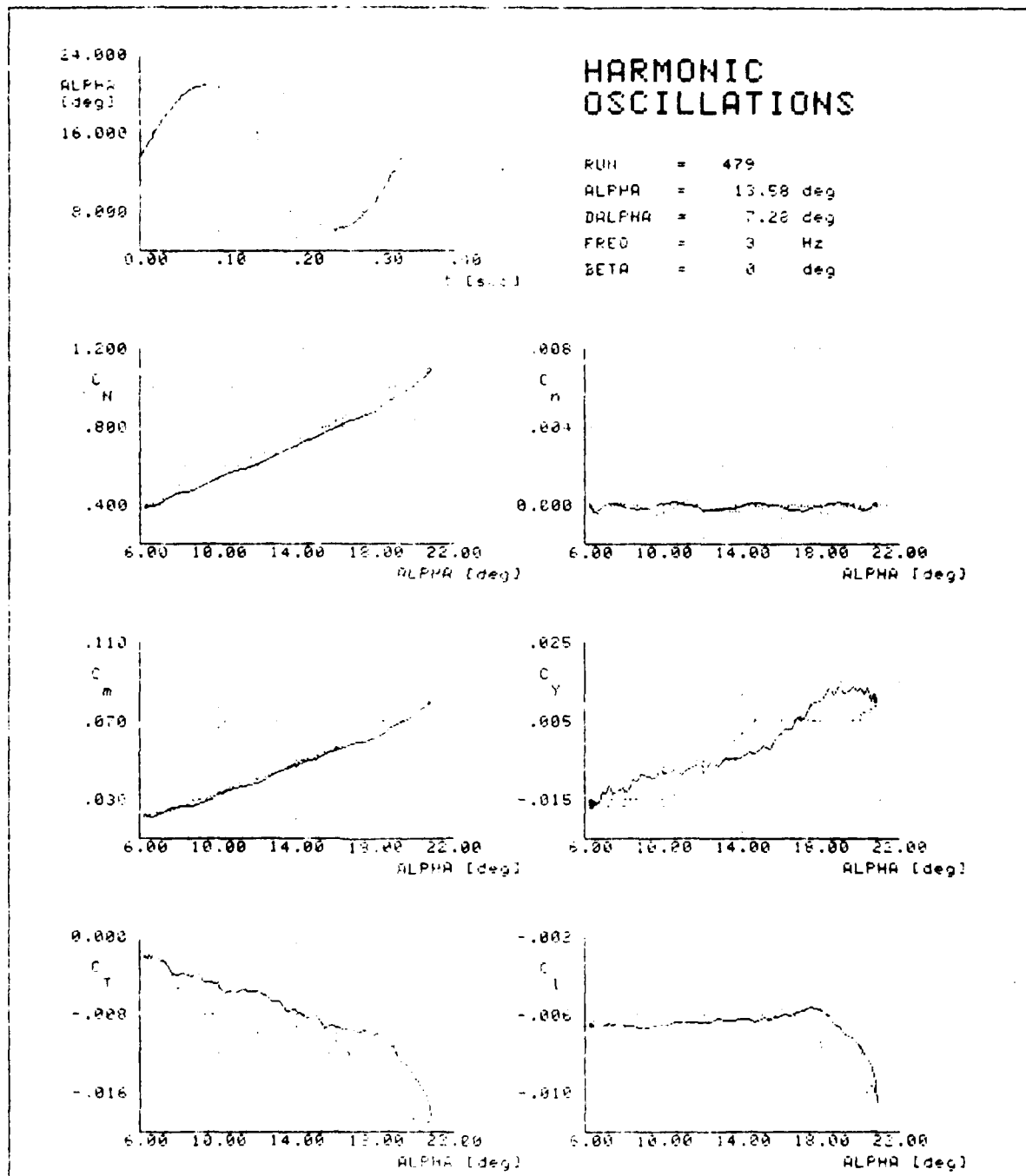


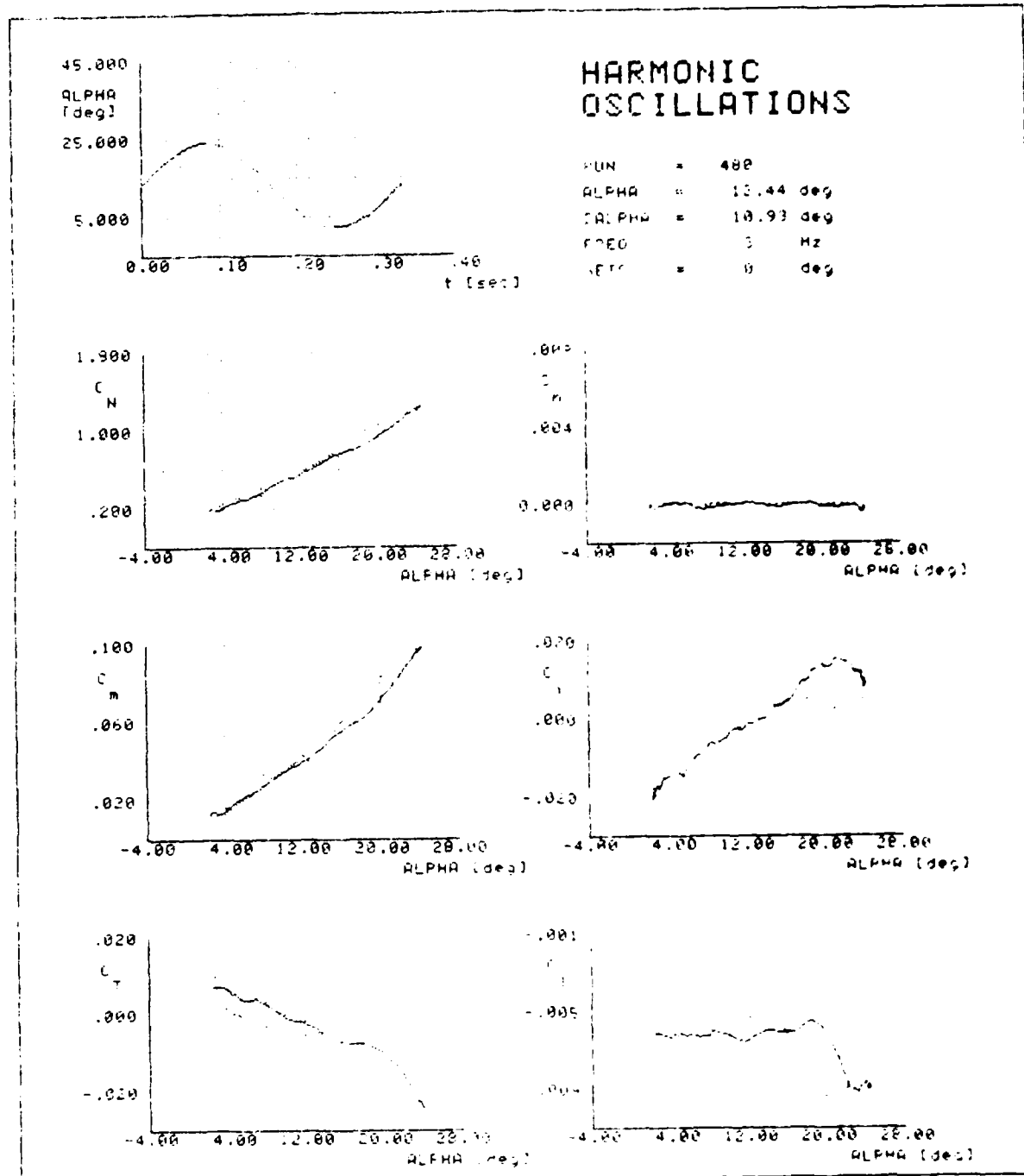


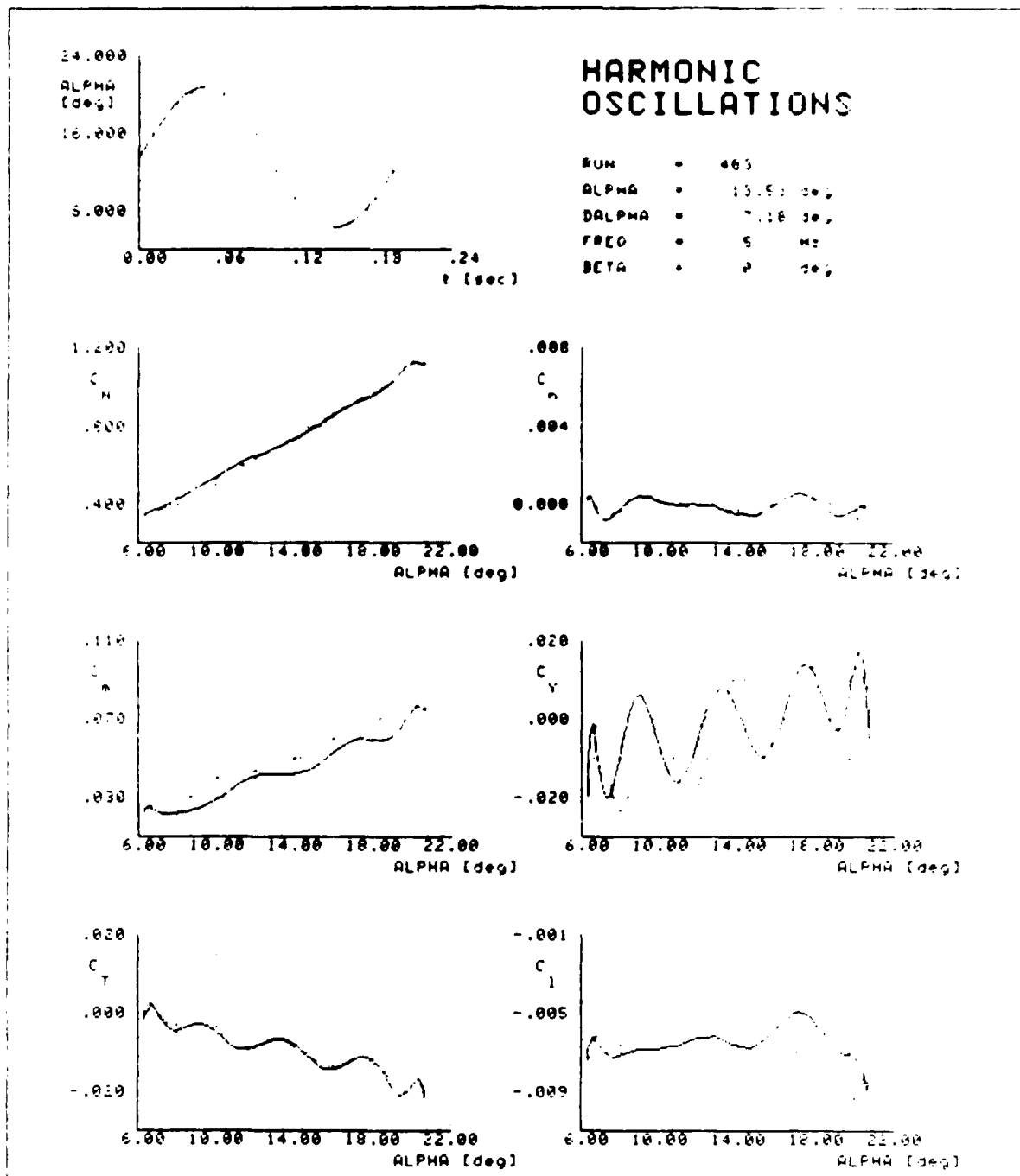
# HARMONIC OSCILLATIONS

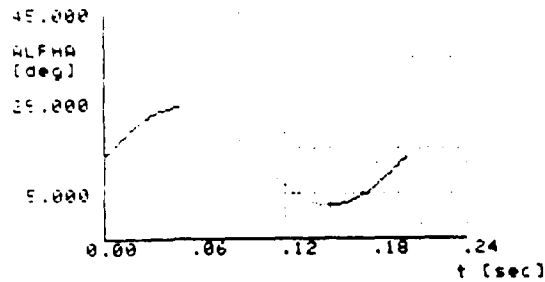
RUN = 474  
ALPHA = 5.66 deg  
DALPHA = 7.26 deg  
FREQ = 6 Hz  
BETA = 0 deg





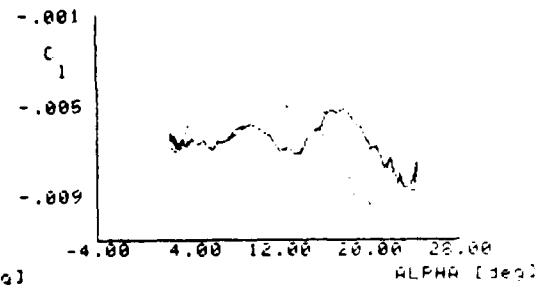
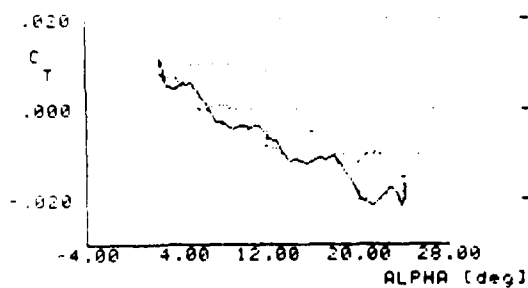
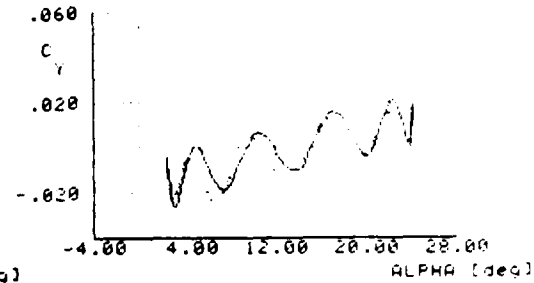
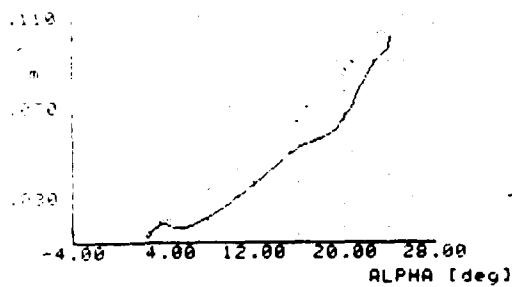
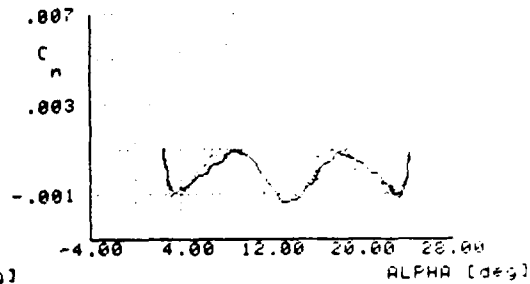
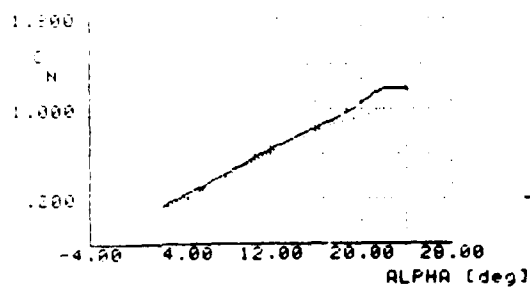


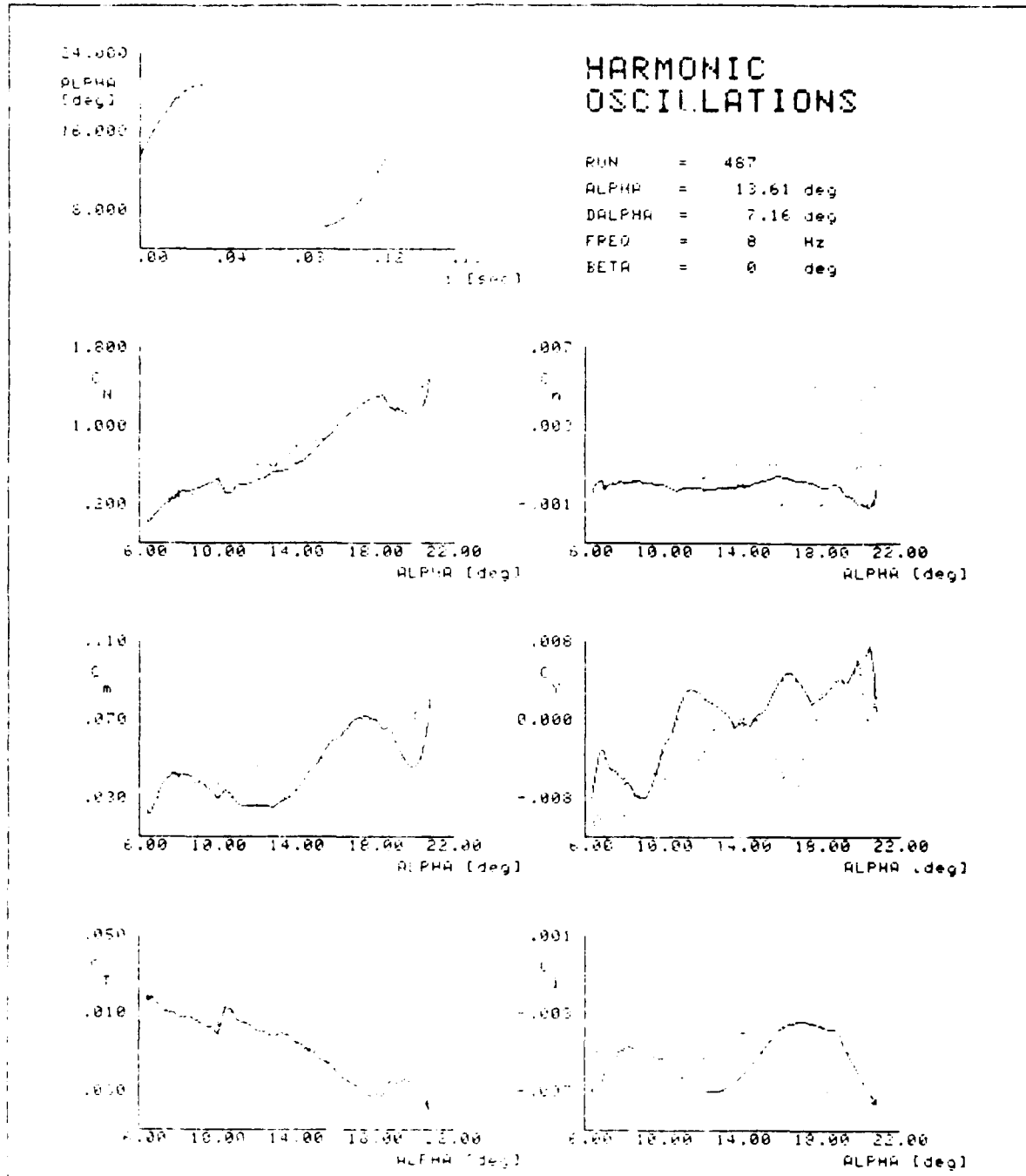


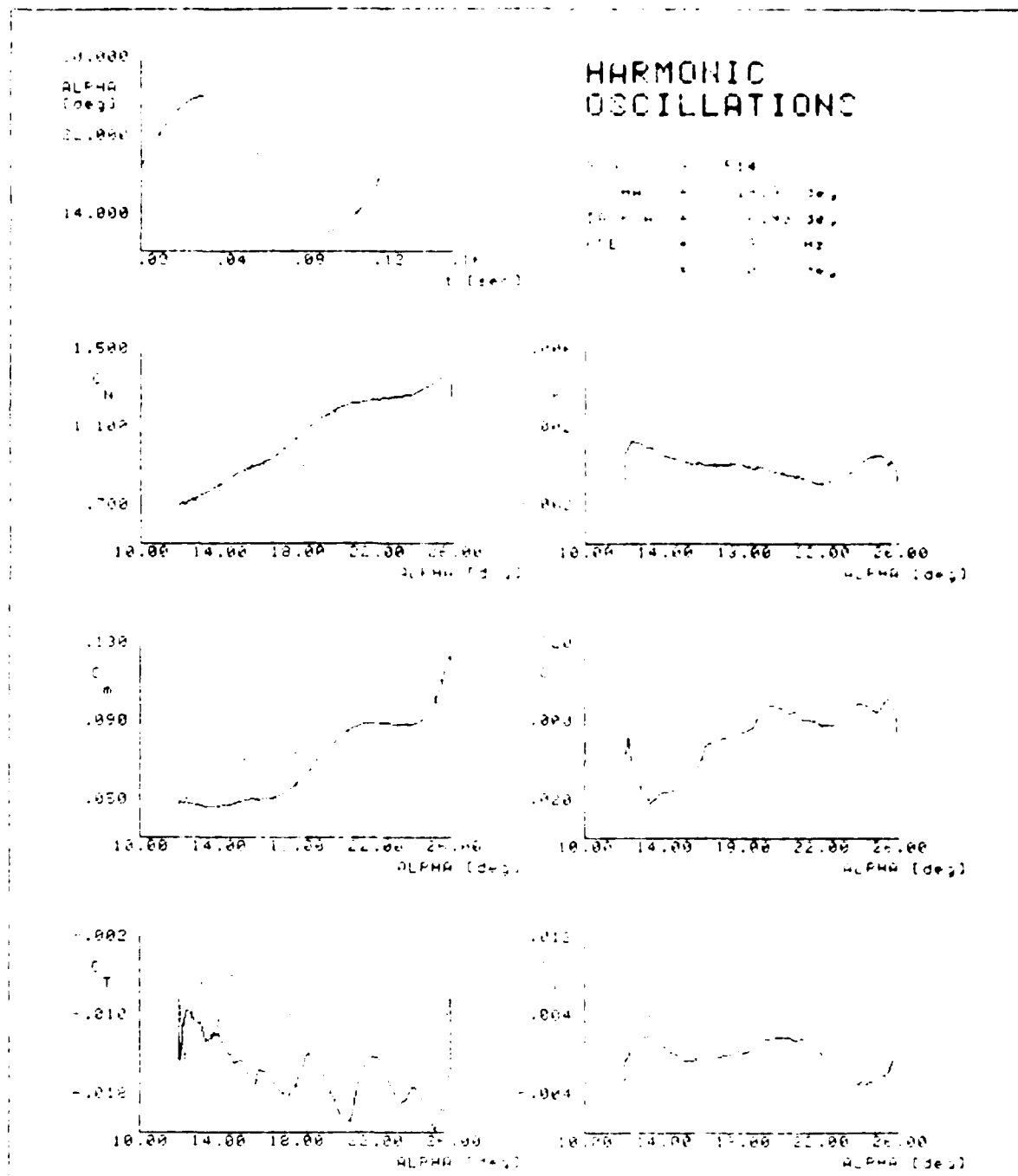


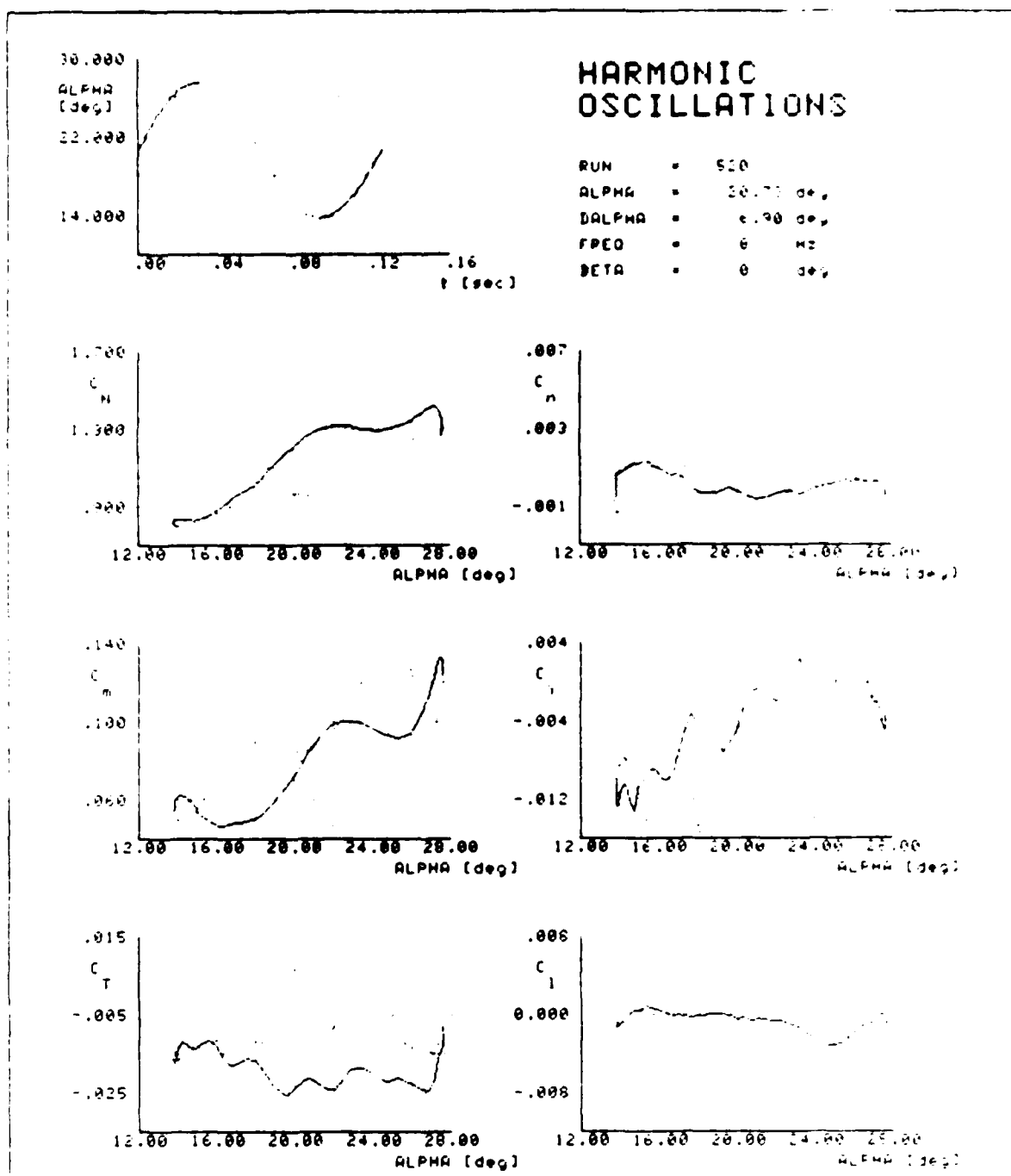
# HARMONIC OSCILLATIONS

RUN = 484  
 ALPHA = 13.44 deg  
 DALPHA = 10.84 deg  
 FREQ = 5 Hz  
 BETA = 0 deg

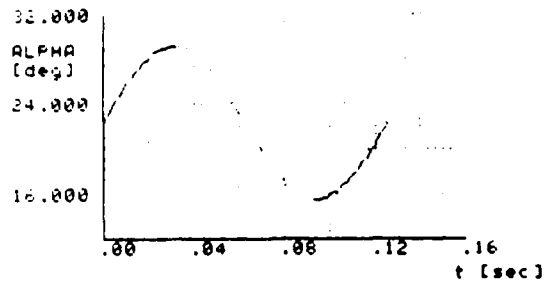






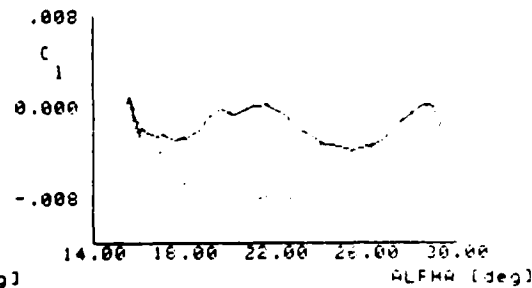
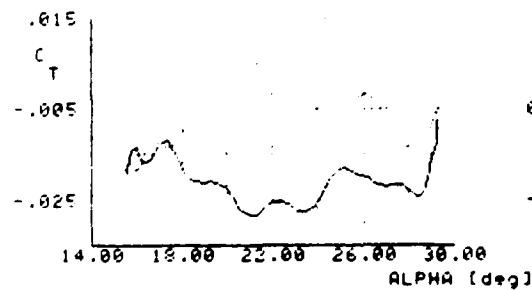
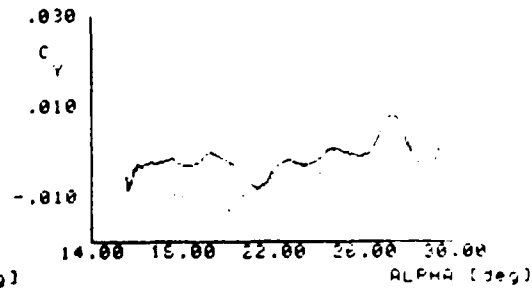
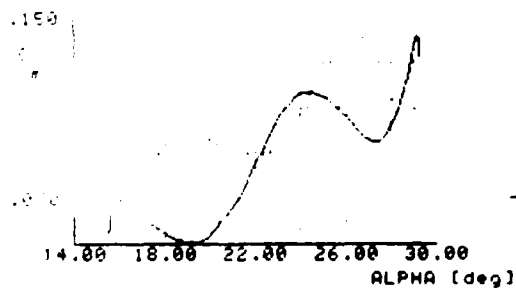
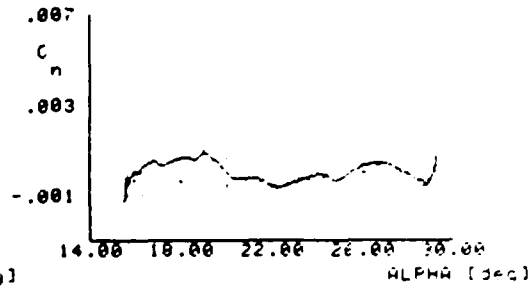
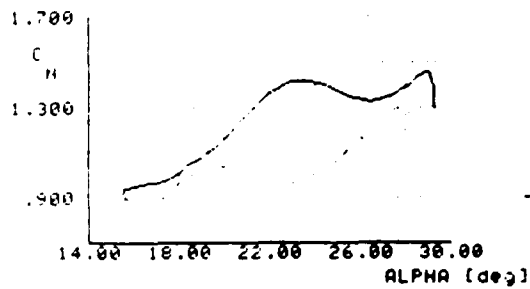


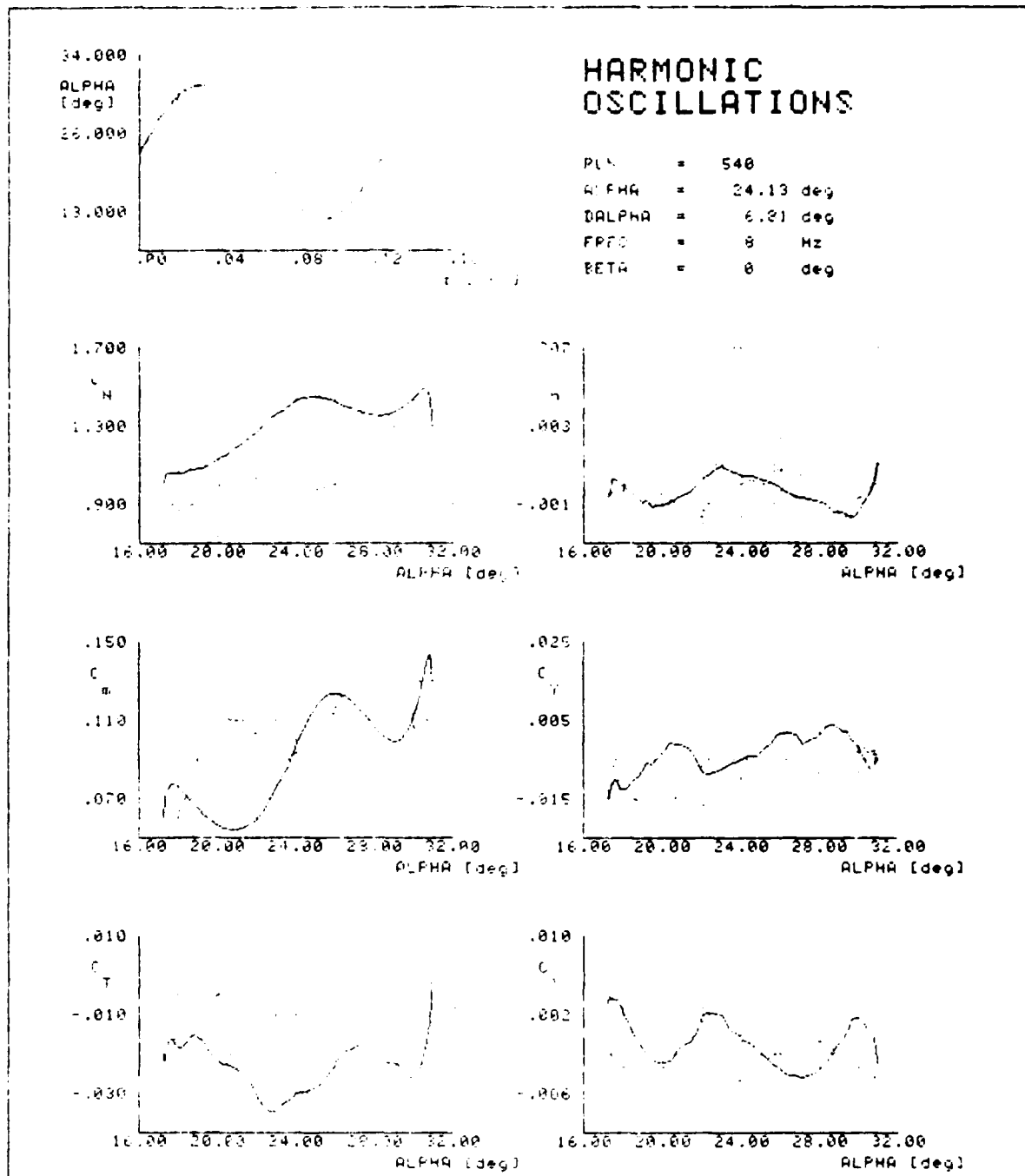


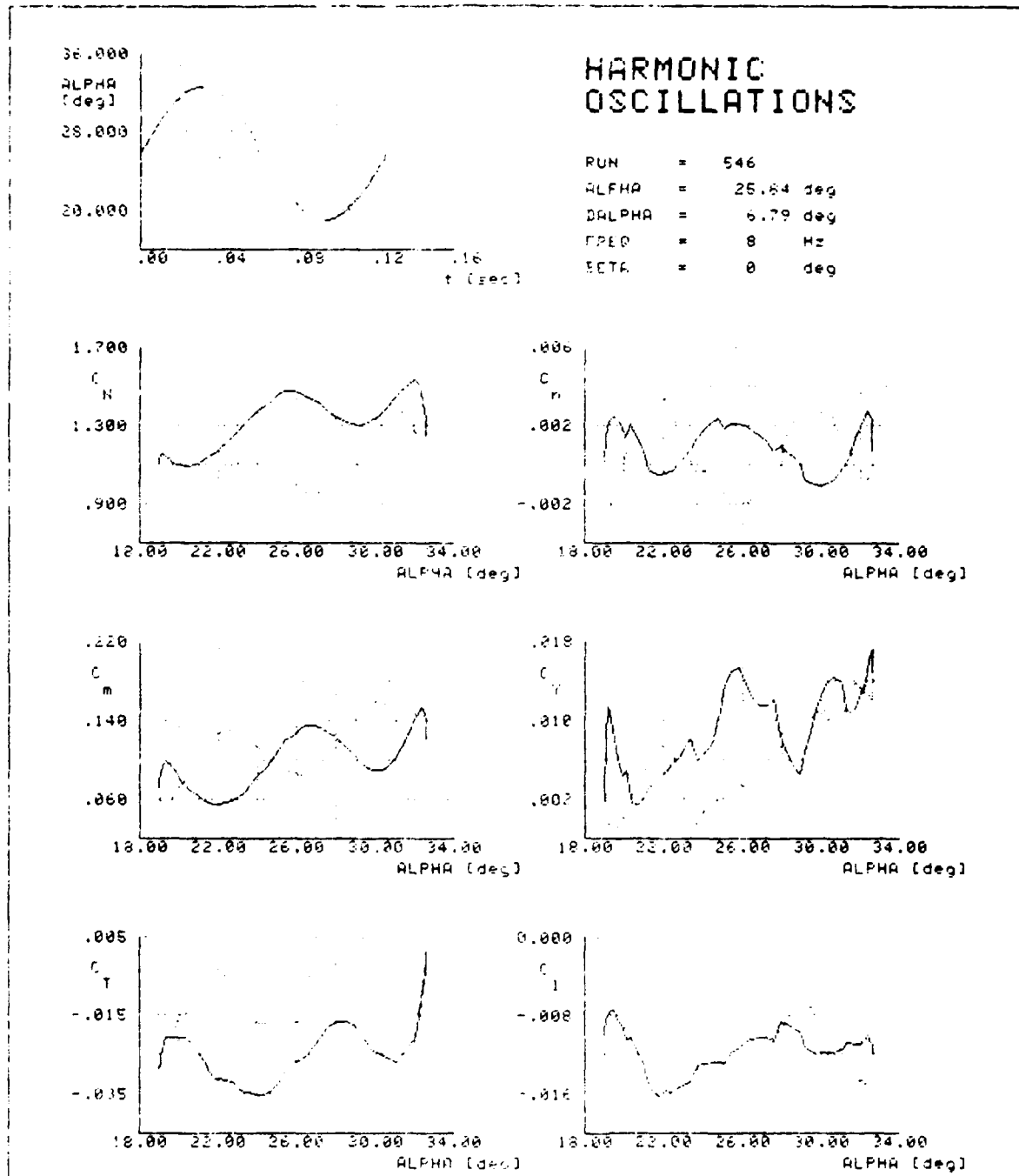


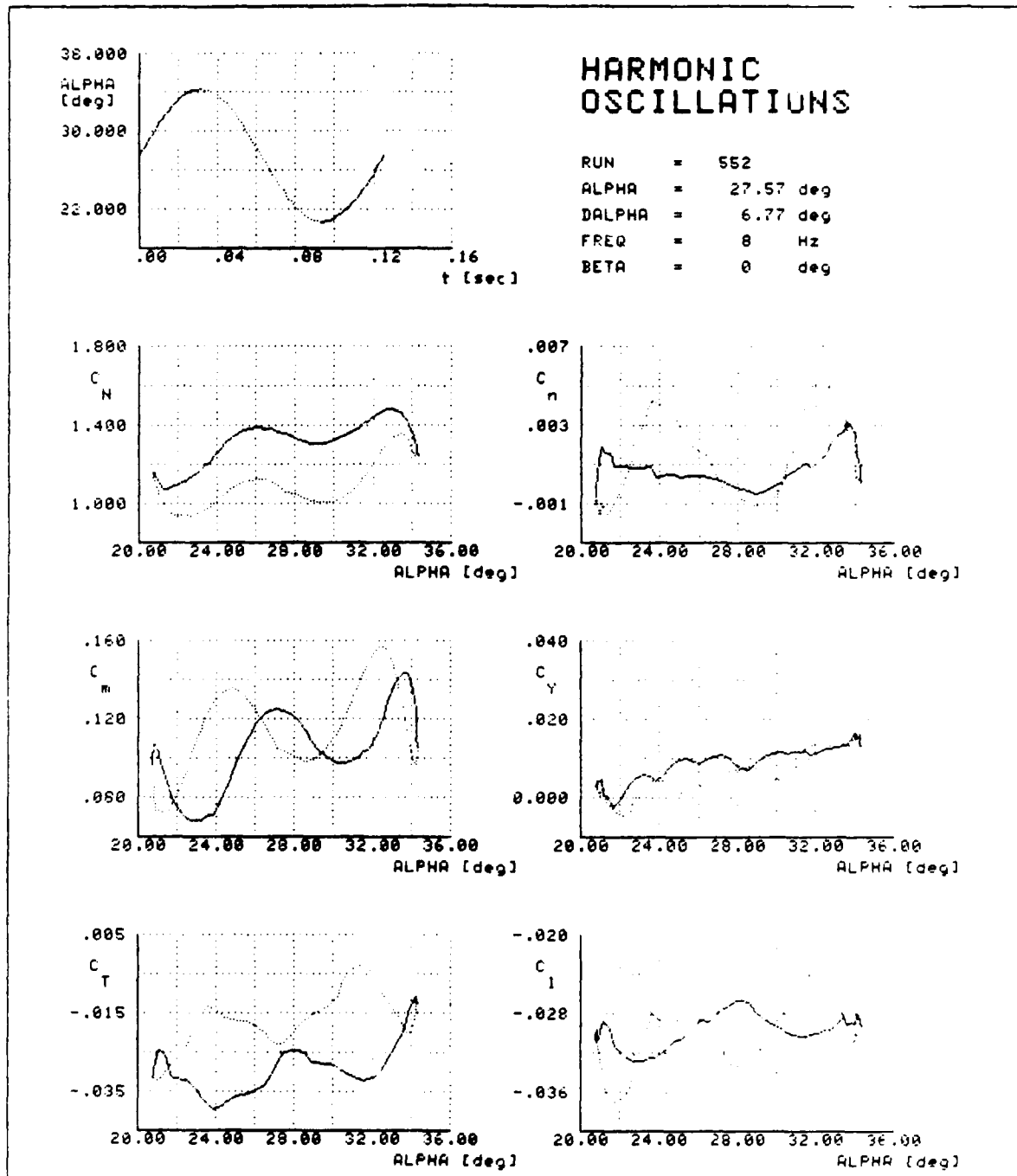
# HARMONIC OSCILLATIONS

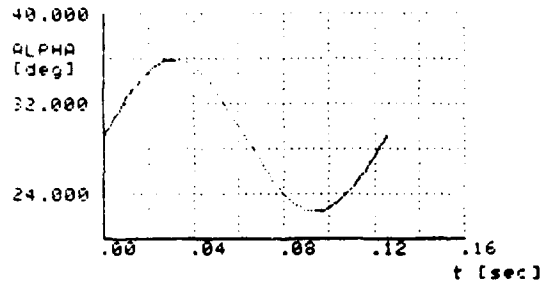
RUN = 532  
 ALPHA = 22.44 deg  
 DALPHA = 6.66 deg  
 FREQ = 8 Hz  
 BETA = 0 deg





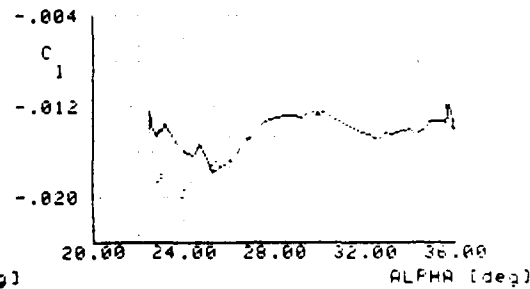
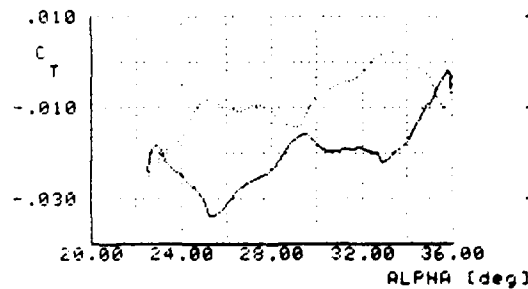
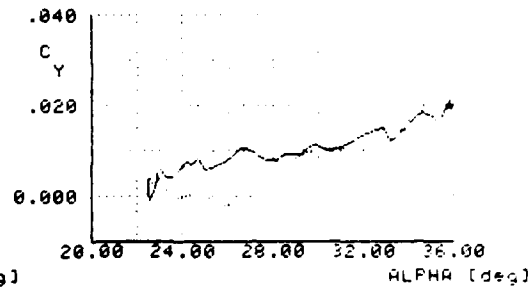
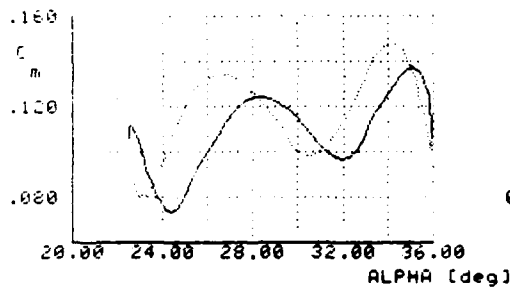
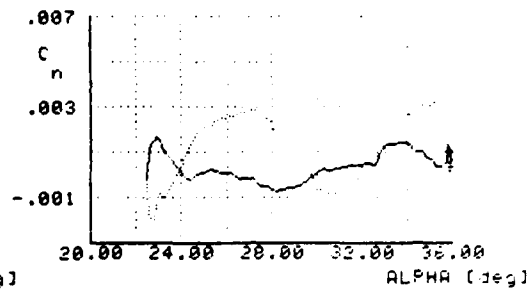
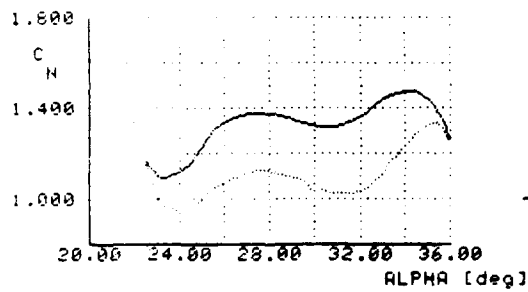


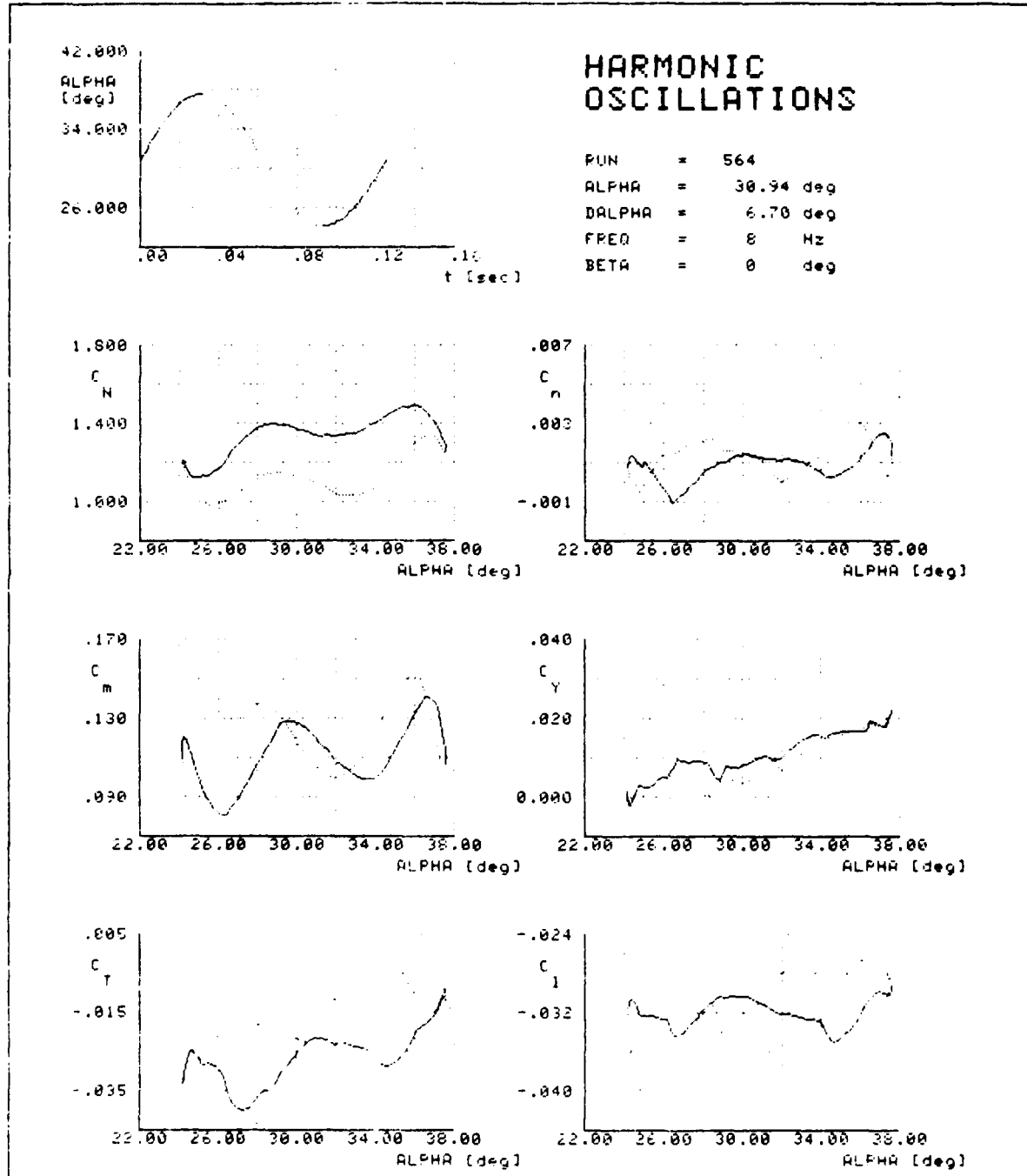


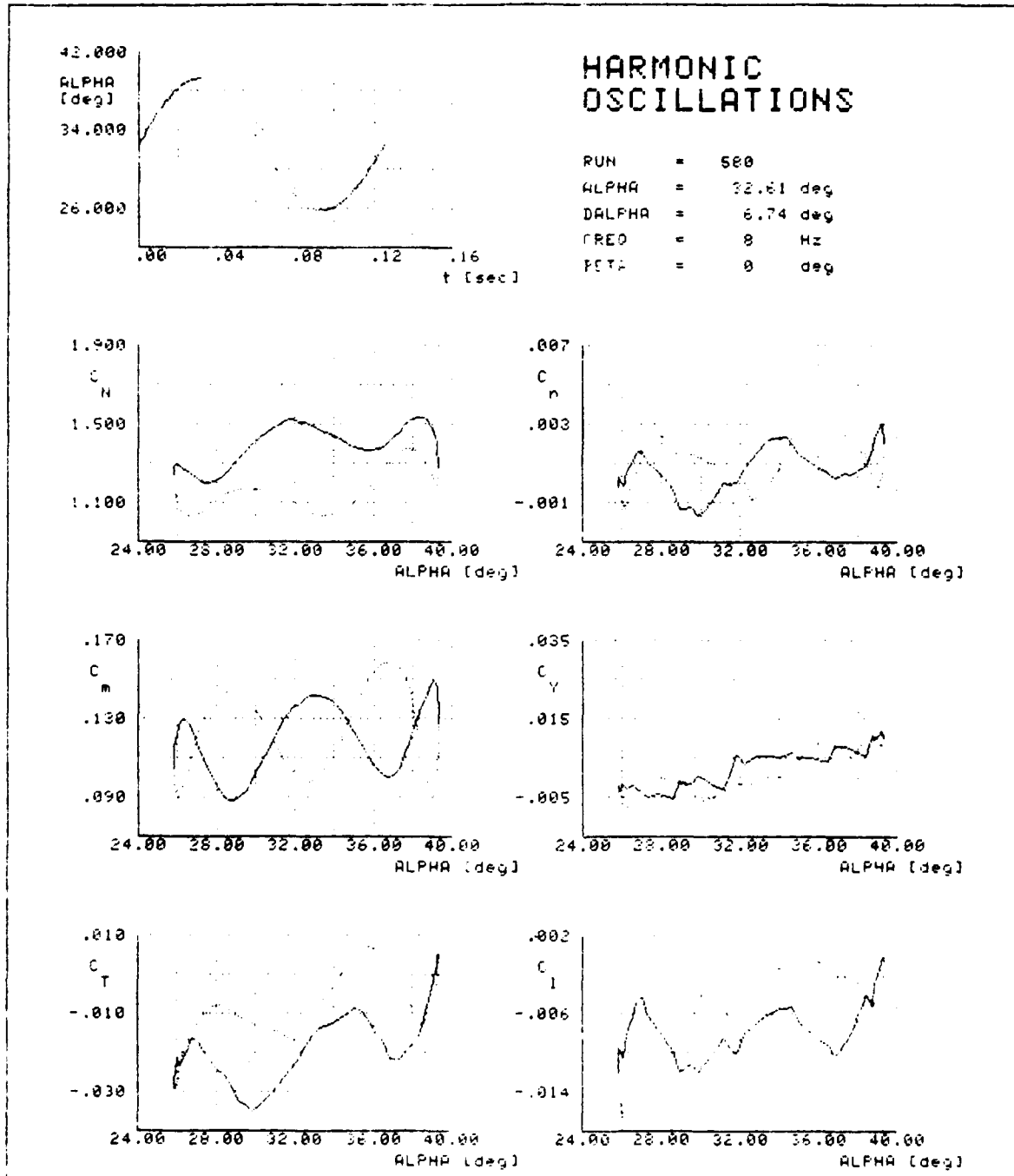


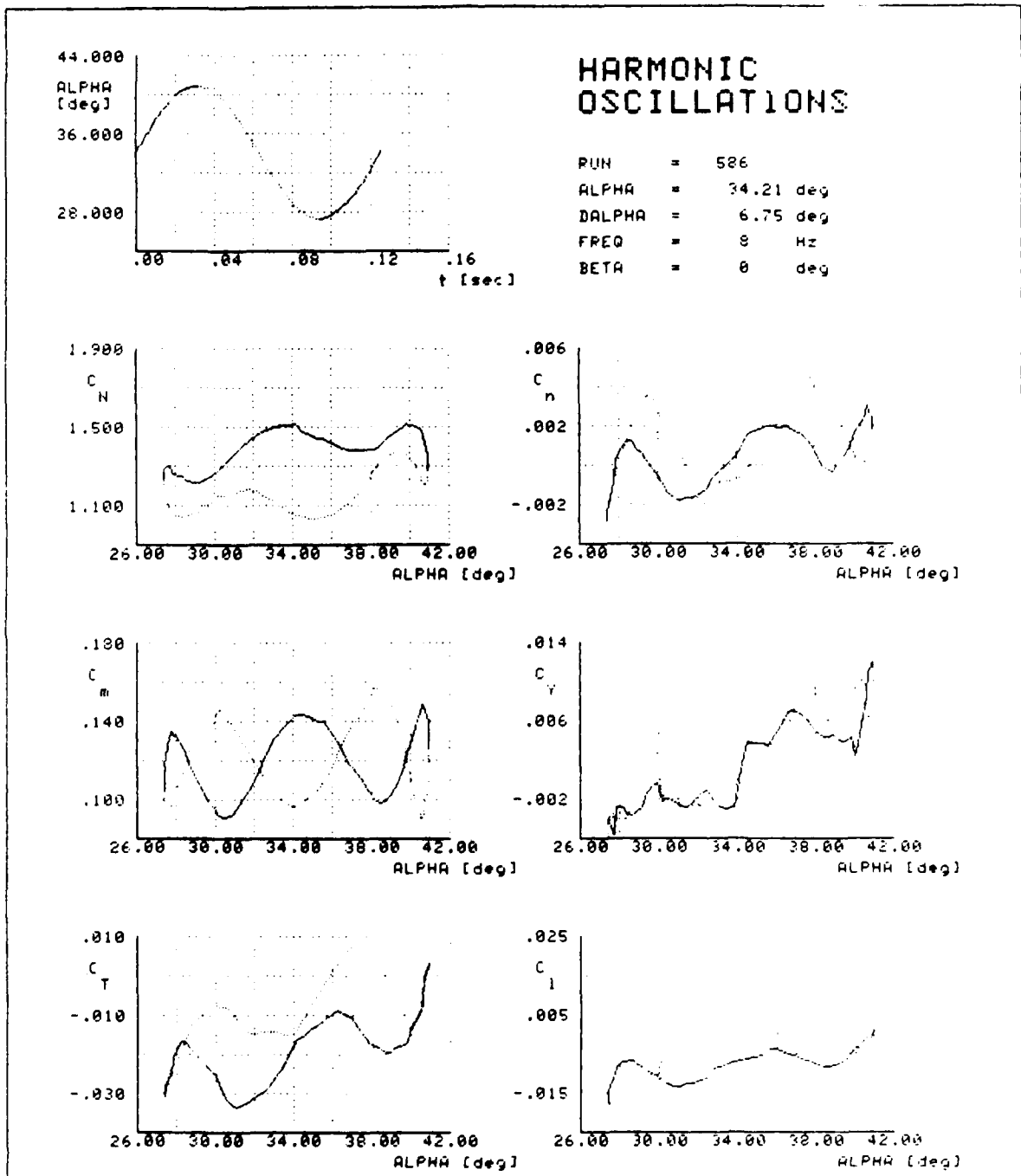
# HARMONIC OSCILLATIONS

RUN = 558  
ALPHA = 29.25 deg  
DALPHA = 6.74 deg  
FREQ = 8 Hz  
BETA = 0 deg

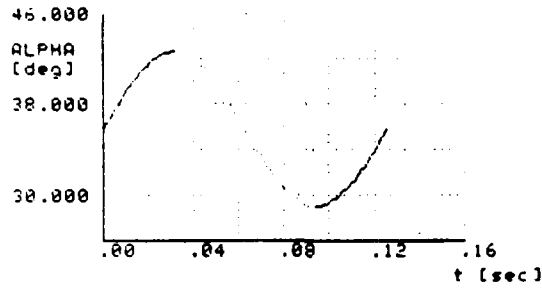






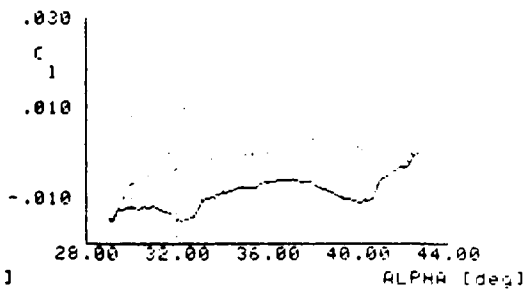
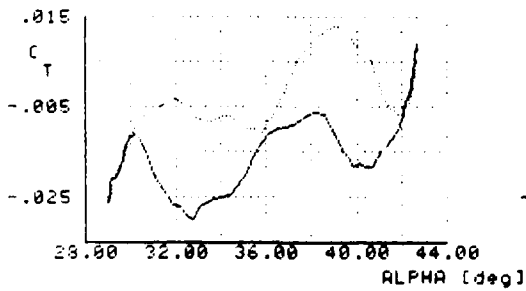
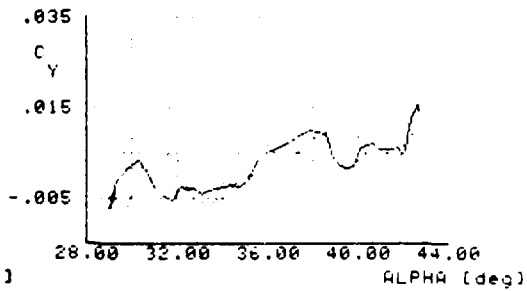
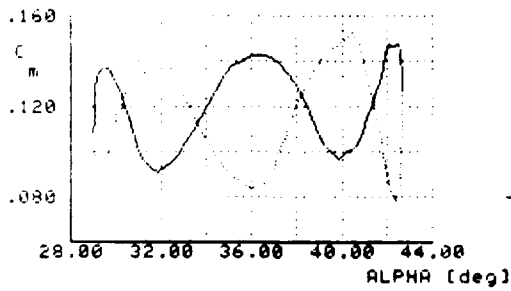
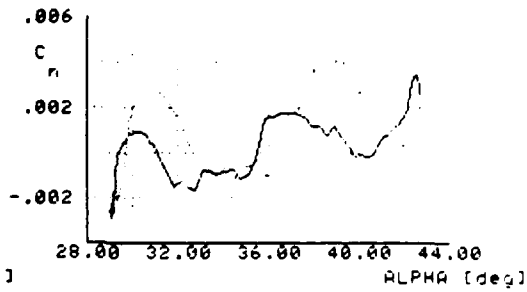
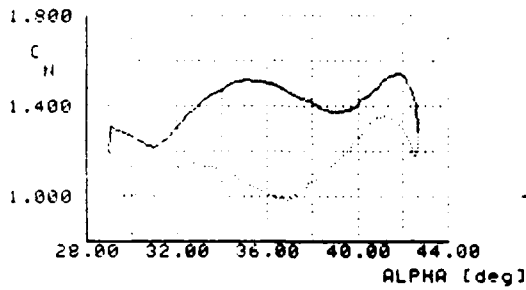


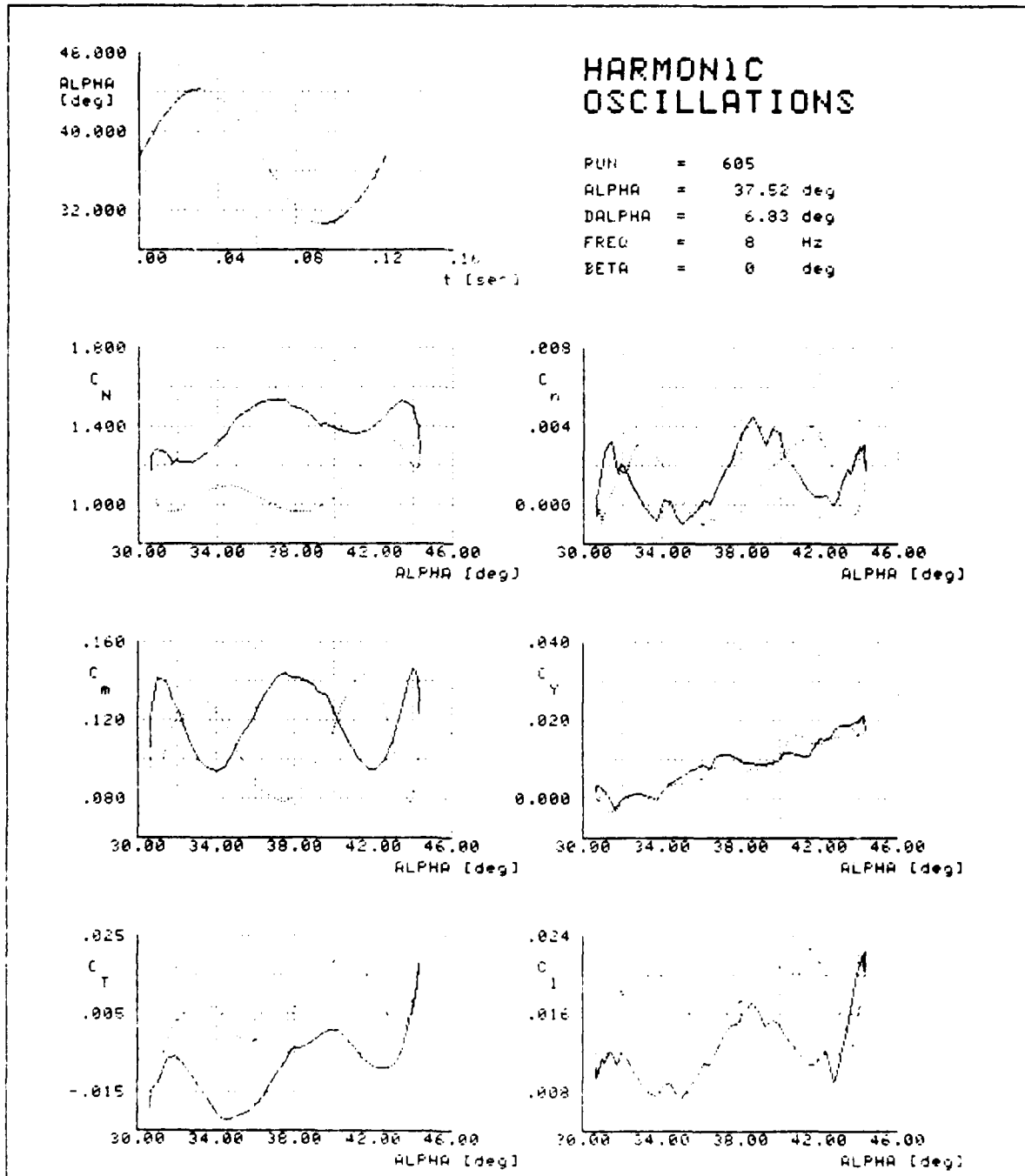


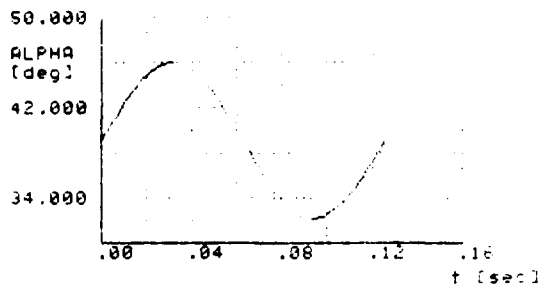


# HARMONIC OSCILLATIONS

RUN = 597  
 ALPHA = 35.88 deg  
 DALPHA = 6.80 deg  
 FREQ = 8 Hz  
 BETA = 0 deg

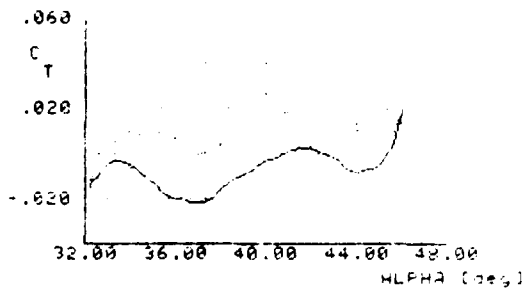
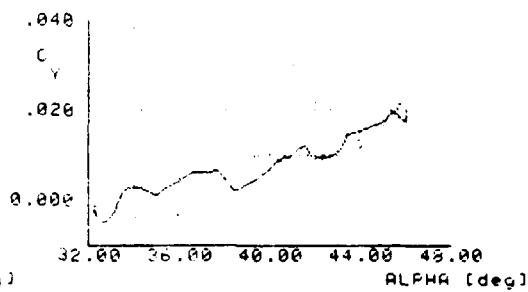
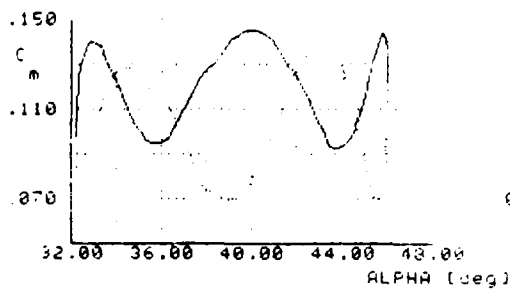
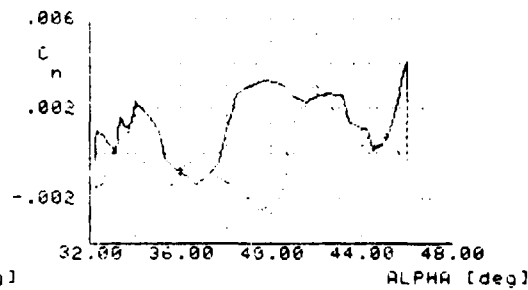
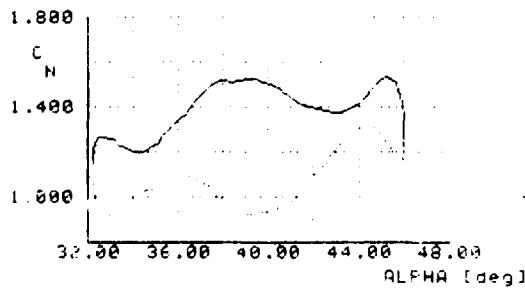


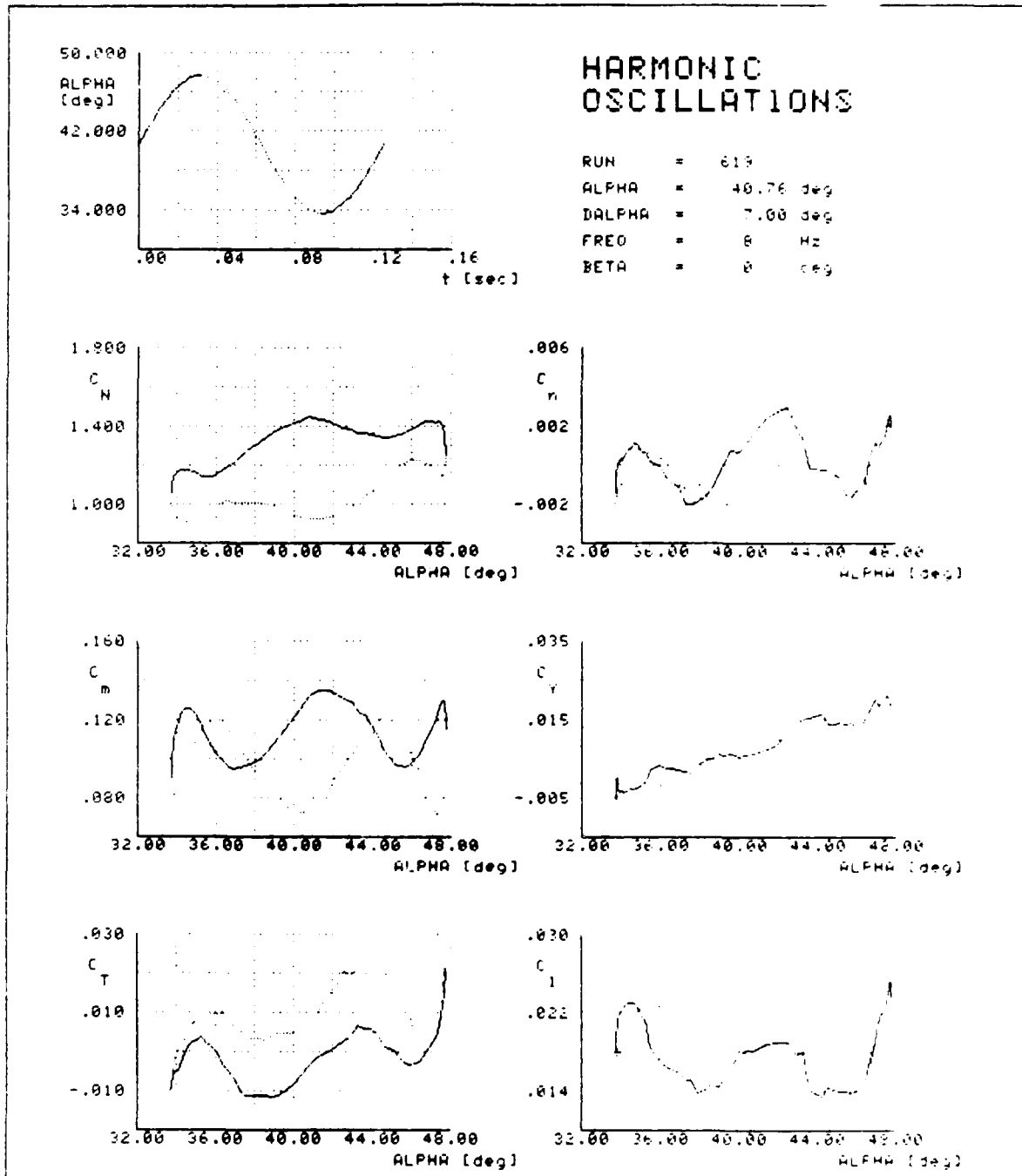


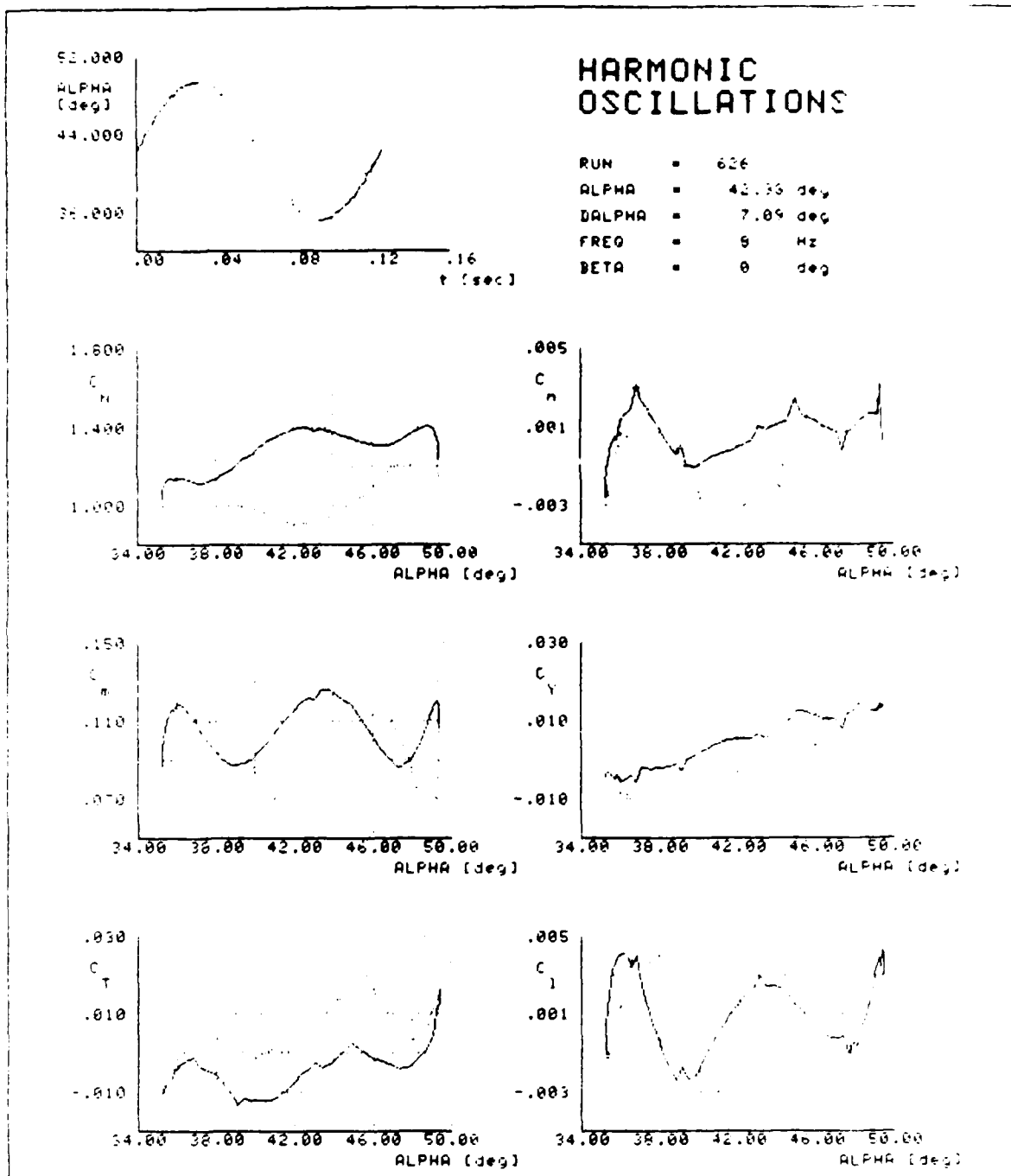


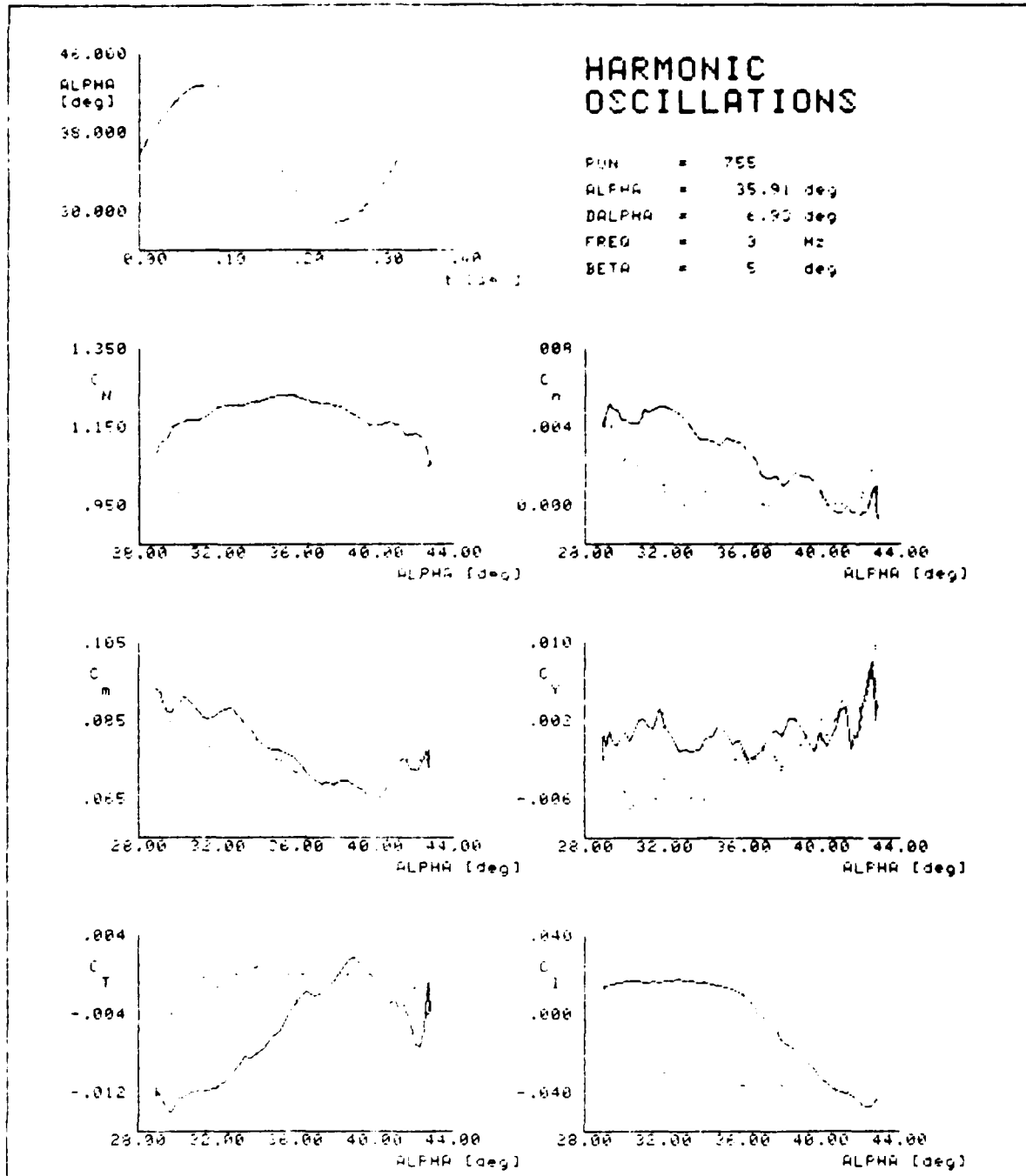
# HARMONIC OSCILLATIONS

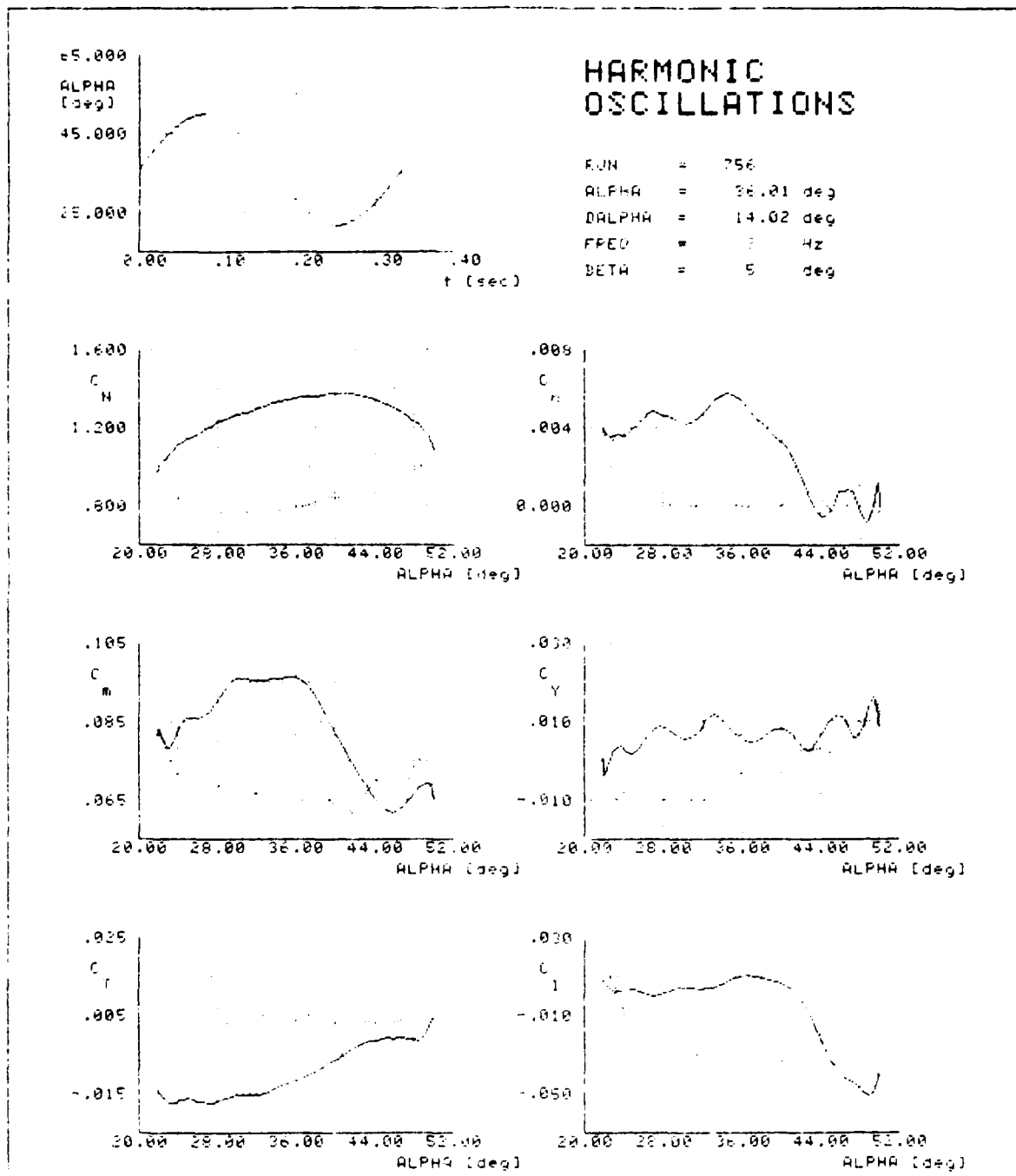
RUN = 612  
ALPHA = 39.15 deg  
DALPHA = 6.90 deg  
FREQ = 8 Hz  
ETA = 0 deg

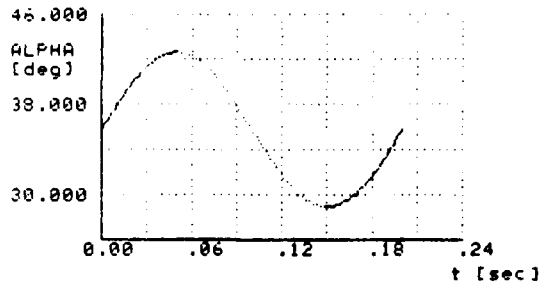






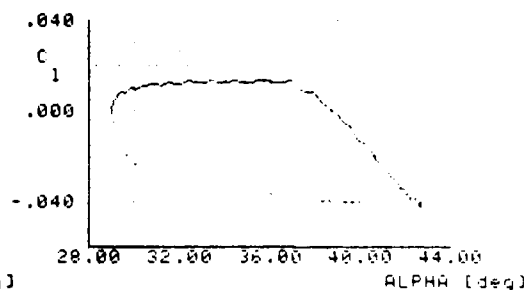
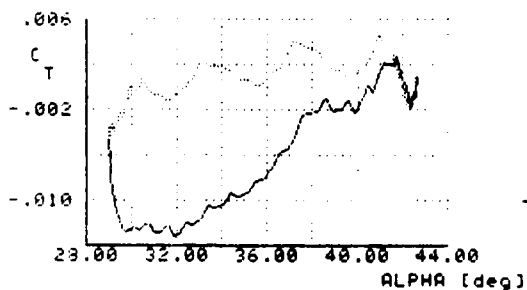
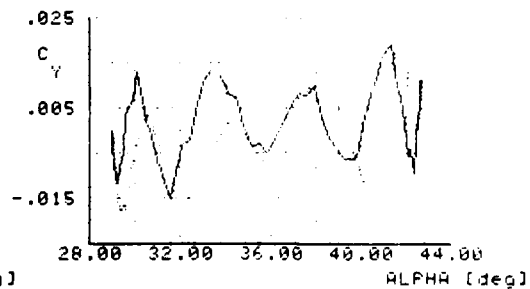
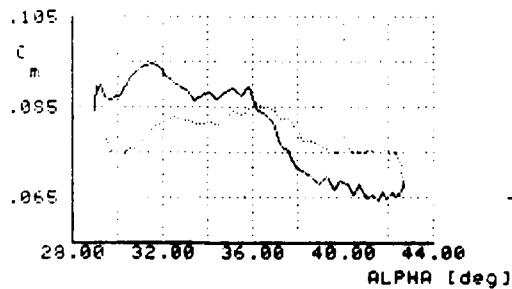
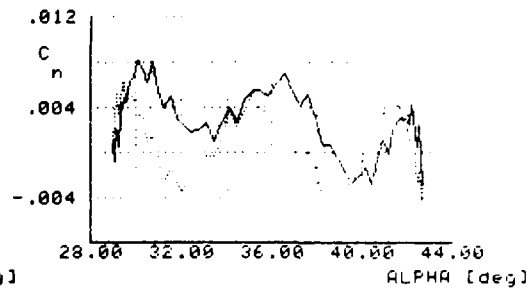
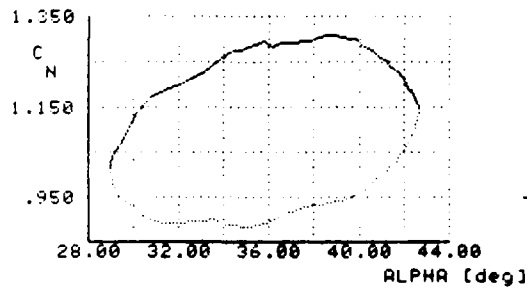




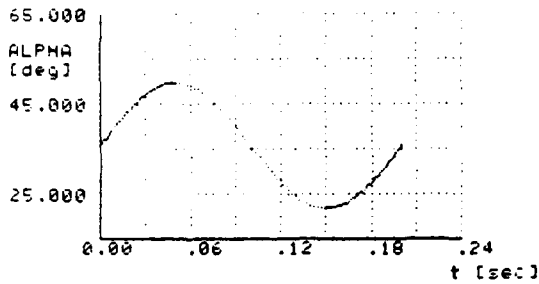


# HARMONIC OSCILLATIONS

RUN = 758  
ALPHA = 35.86 deg  
DALPHA = 6.82 deg  
FREQ = 5 Hz  
BETA = 5 deg

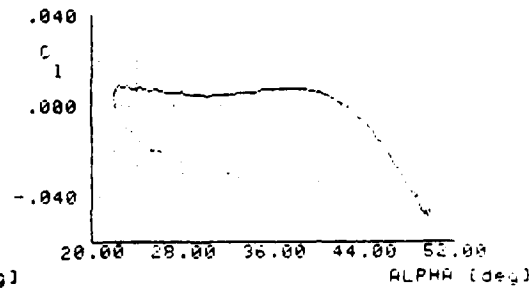
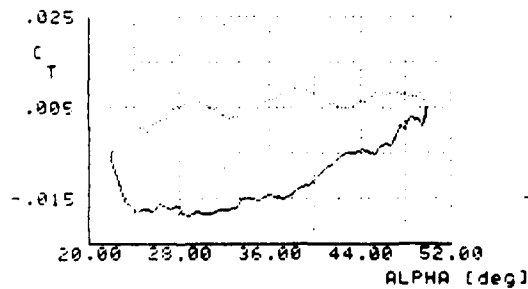
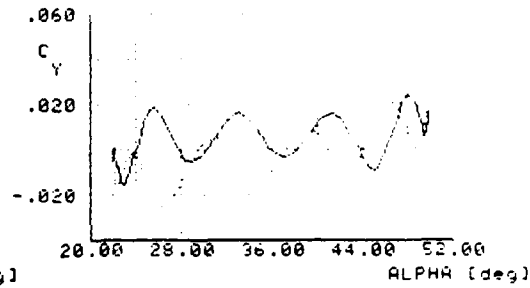
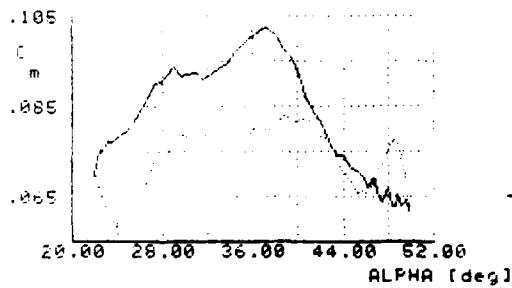
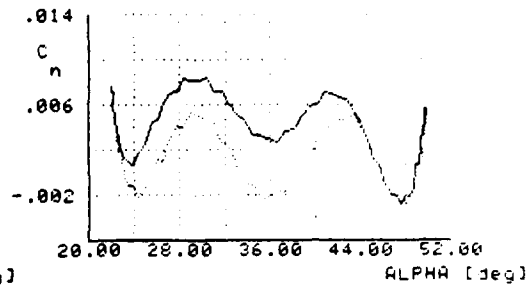
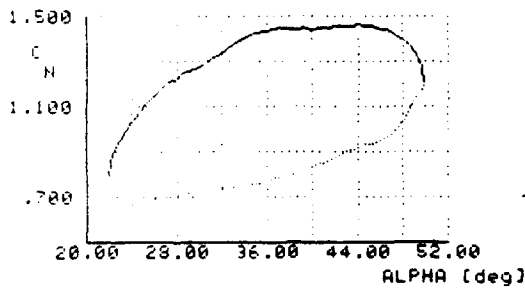


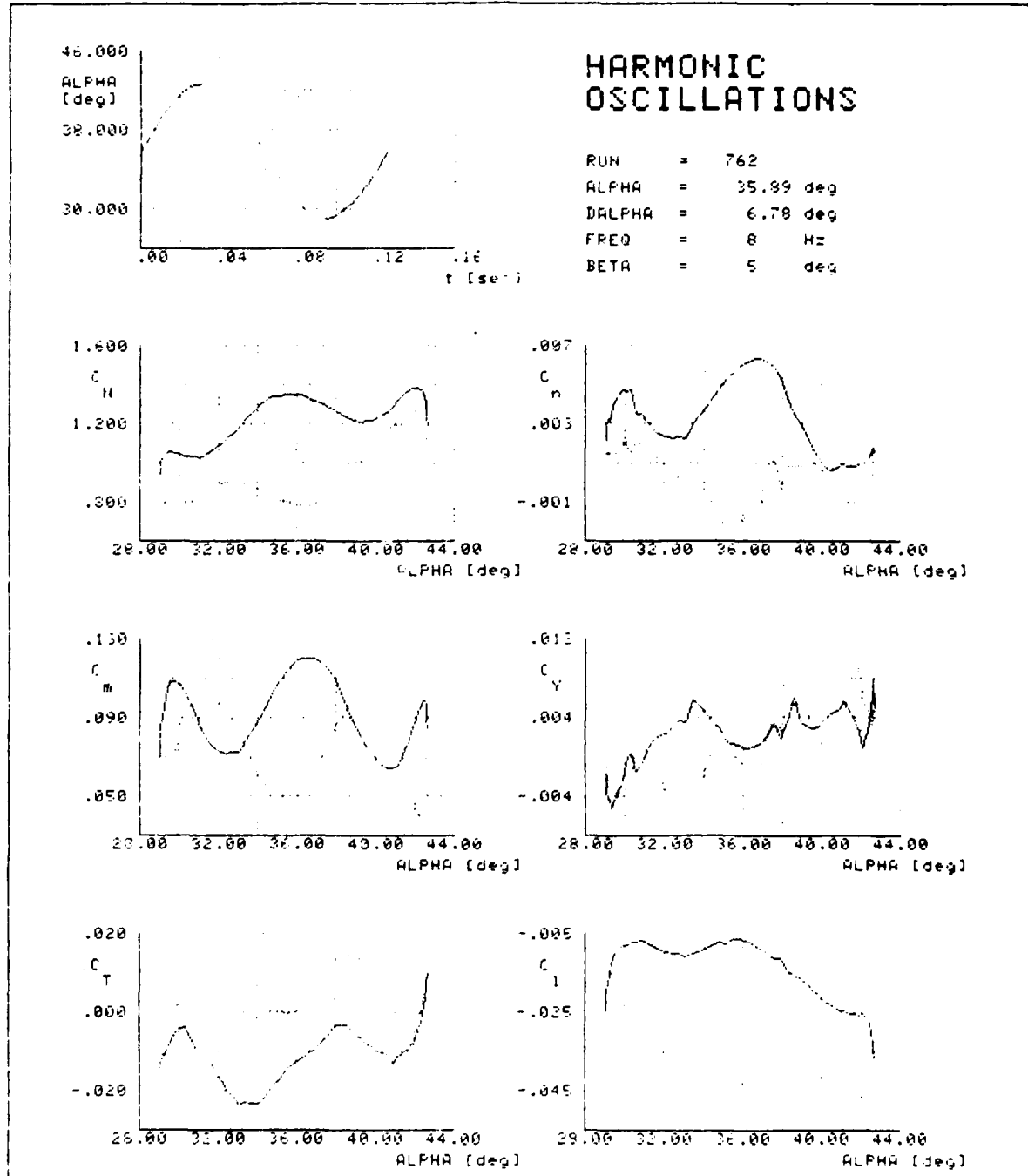


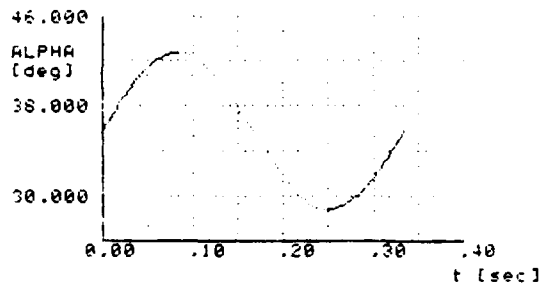


## HARMONIC OSCILLATIONS

RUN = 759  
 ALPHA = 36.00 deg  
 DALPHA = 13.89 deg  
 FREQ = 5 Hz  
 BETA = 5 deg

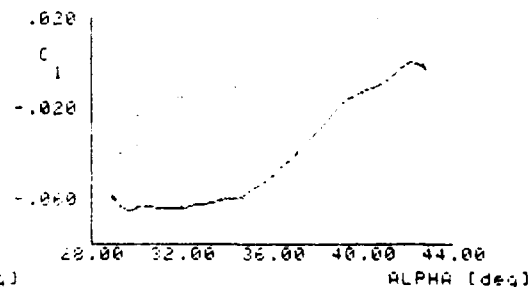
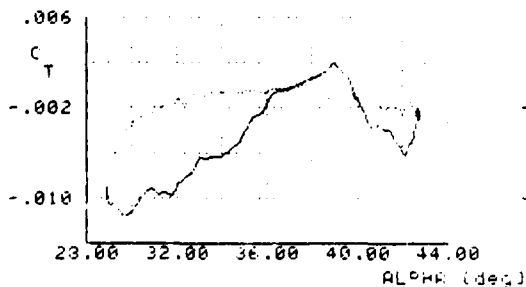
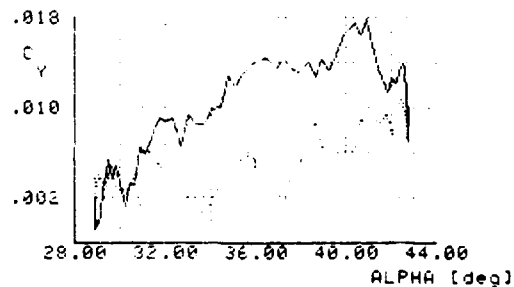
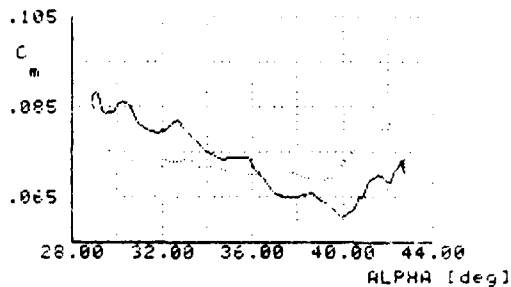
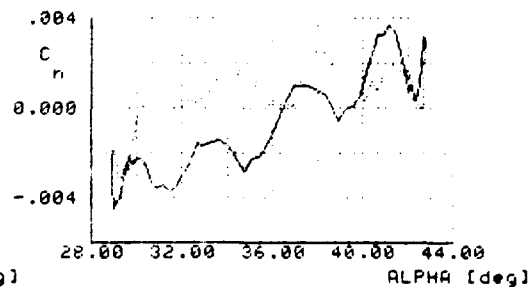
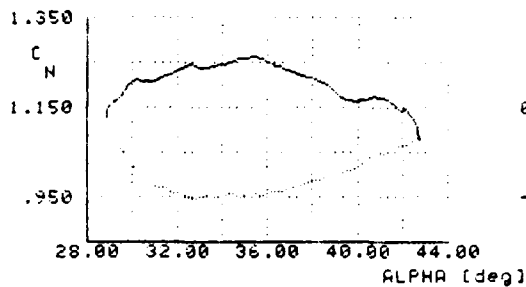


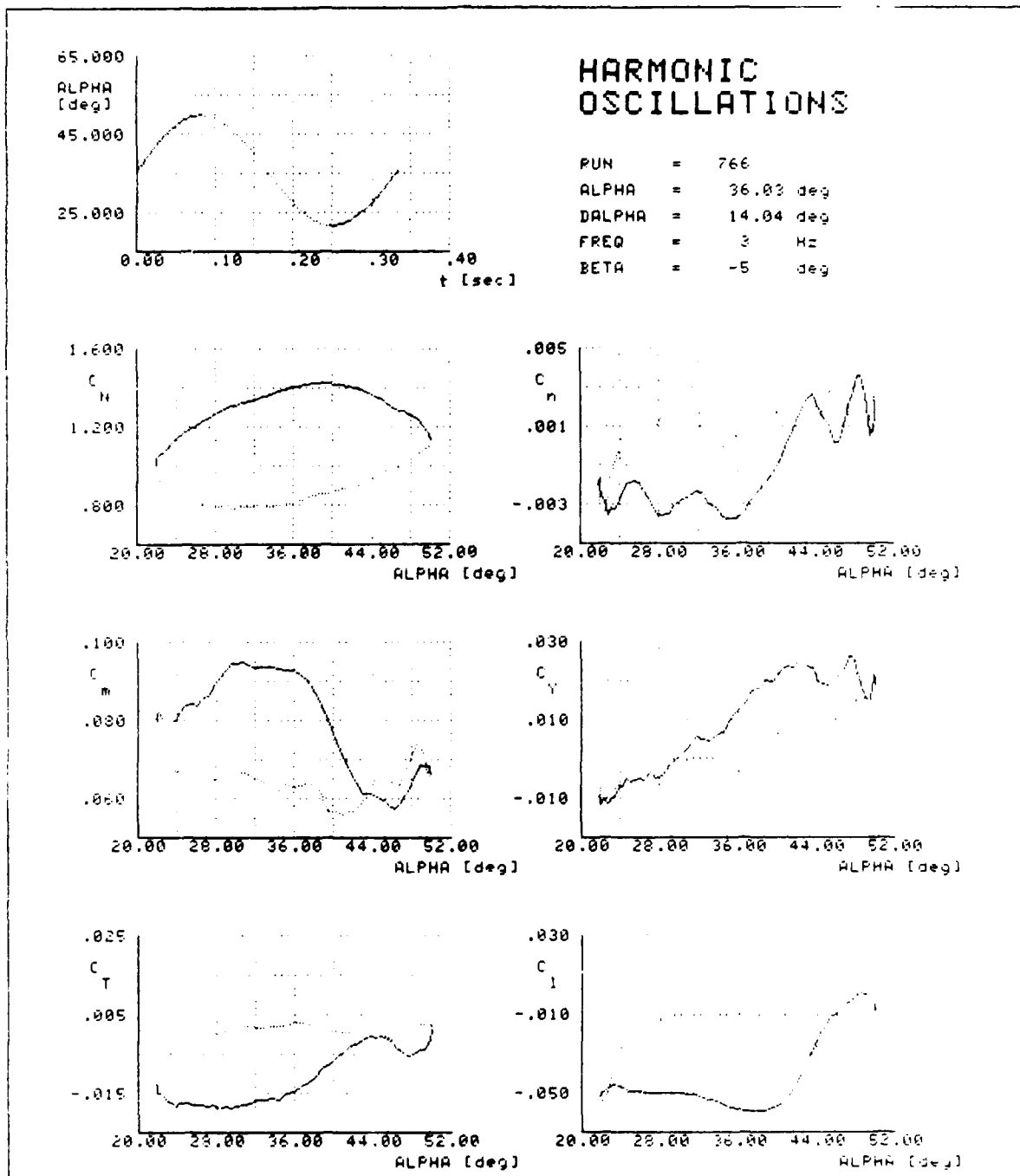


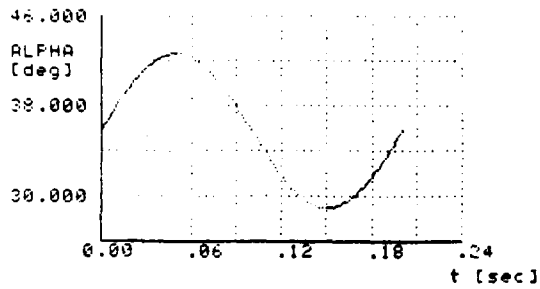


# HARMONIC OSCILLATIONS

RUN = 765  
ALPHA = 35.86 deg  
DALPHA = 6.91 deg  
FREQ = 3 Hz  
BETA = -5 deg

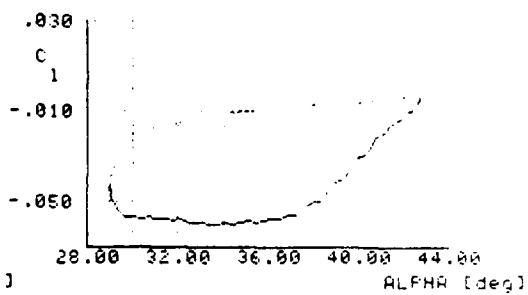
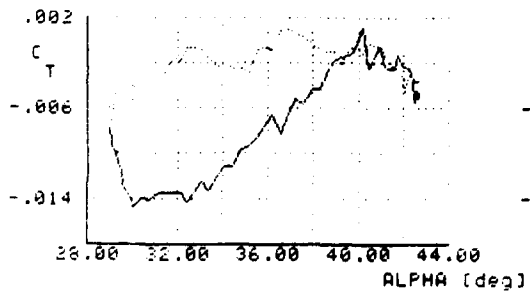
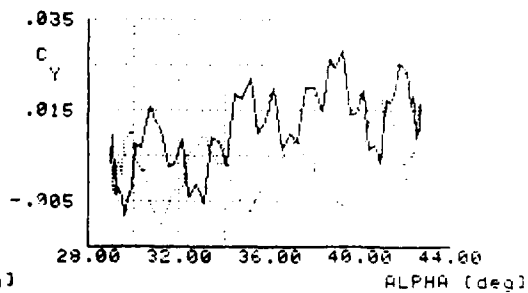
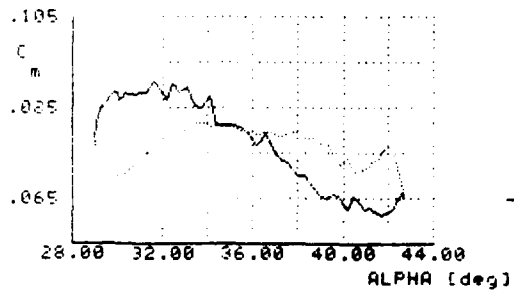
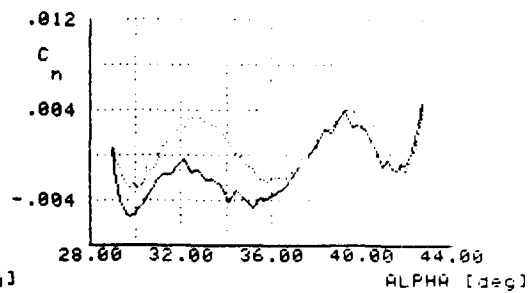
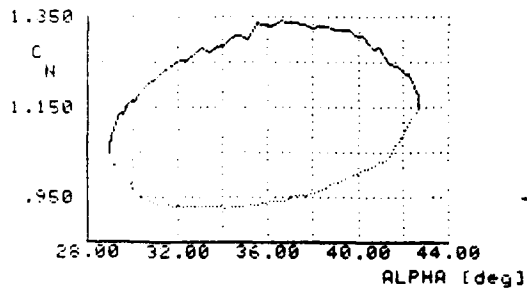


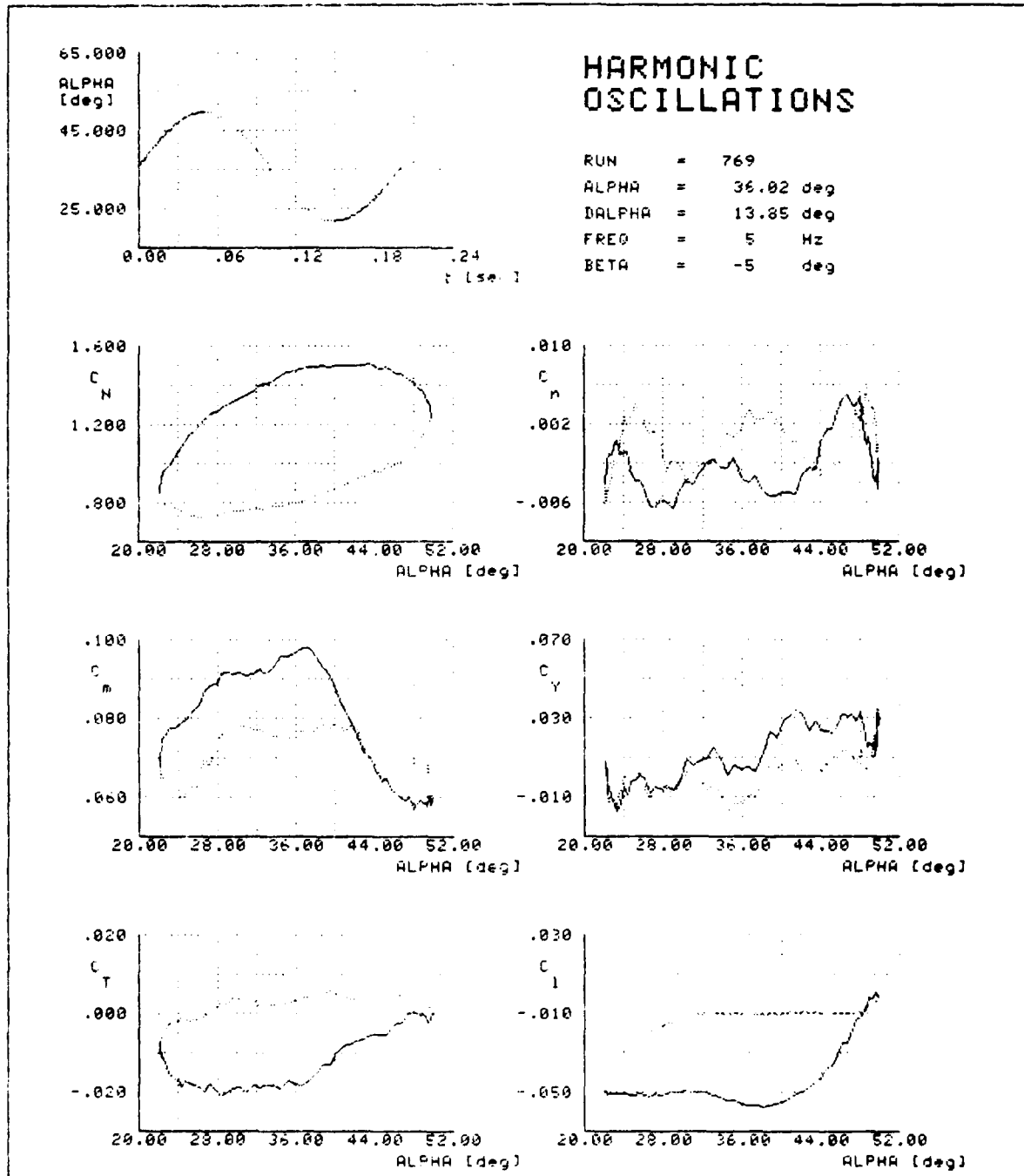


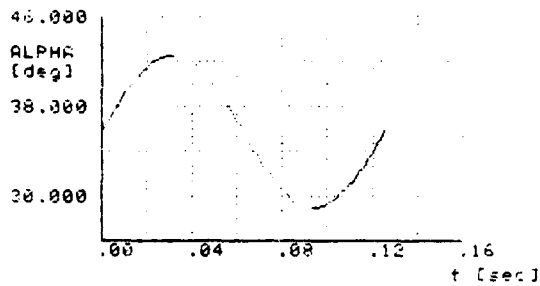


## HARMONIC OSCILLATIONS

RUN = 768  
 ALPHA = 35.89 deg  
 DALPHA = 6.83 deg  
 FREQ = 5 Hz  
 BETA = -5 deg

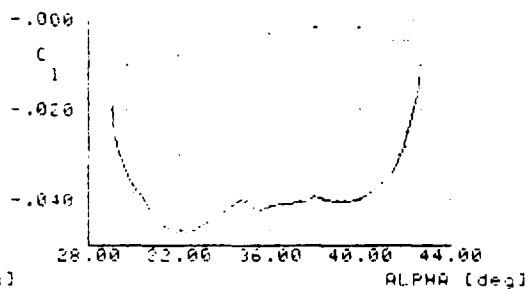
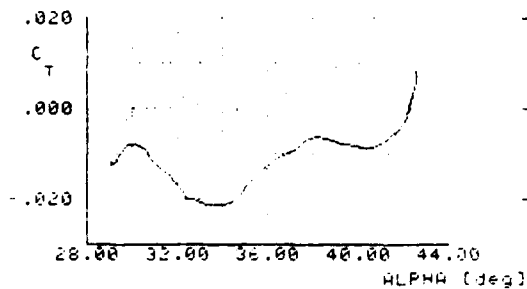
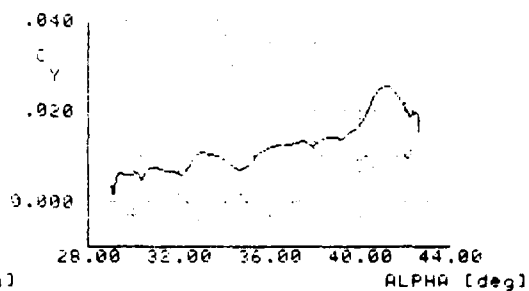
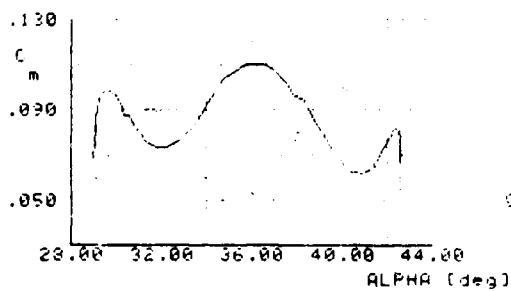
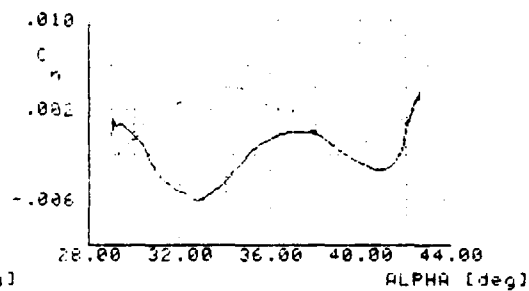
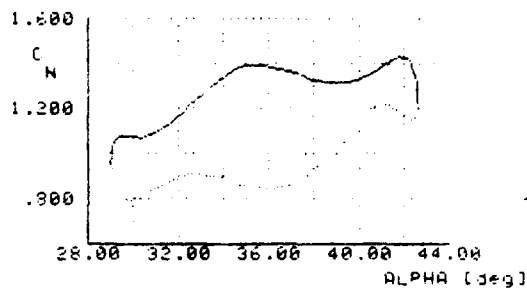


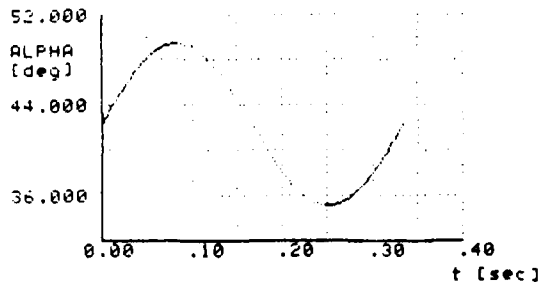




# HARMONIC OSCILLATIONS

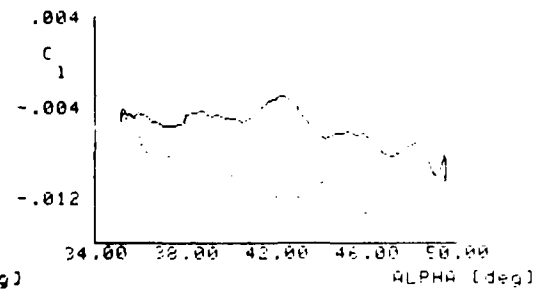
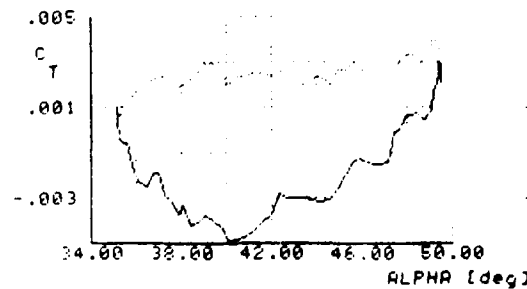
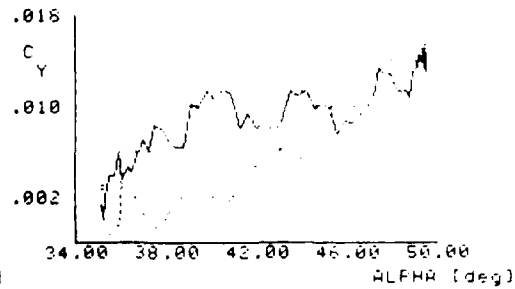
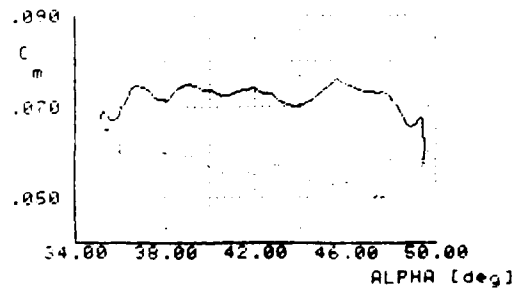
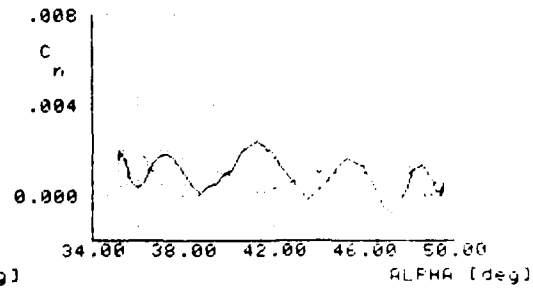
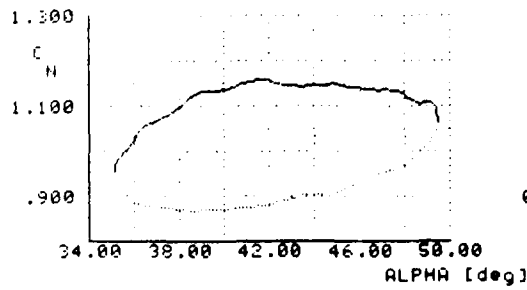
RUN = 772  
ALPHA = 35.86 deg  
DALPHA = 6.78 deg  
FREQ = 8 Hz  
BETA = -5 deg



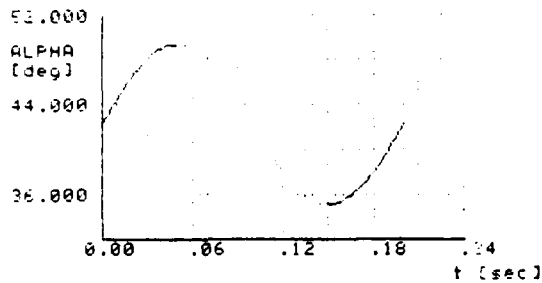


# HARMONIC OSCILLATIONS

RUN = 775  
ALPHA = 42.38 deg  
DALPHA = 7.20 deg  
FREQ = 3 Hz  
BETA = -5 deg

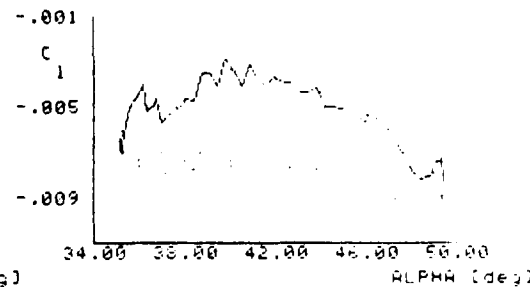
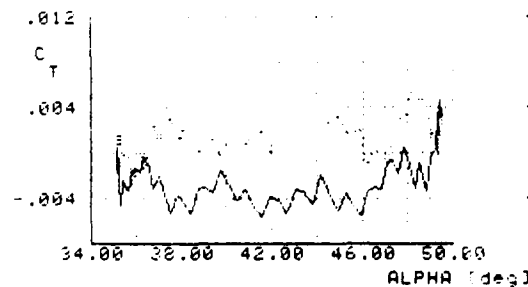
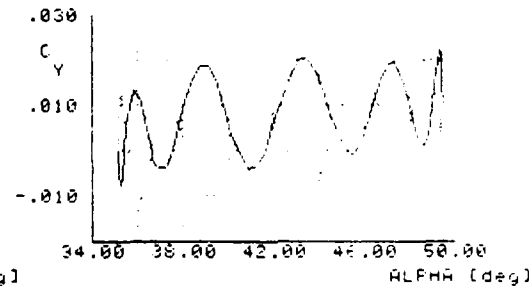
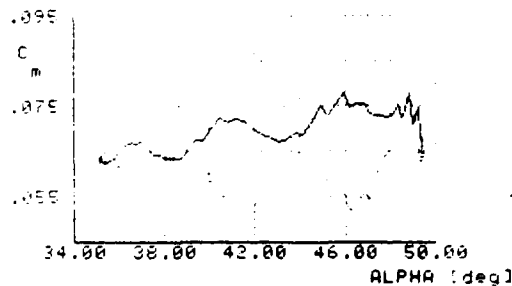
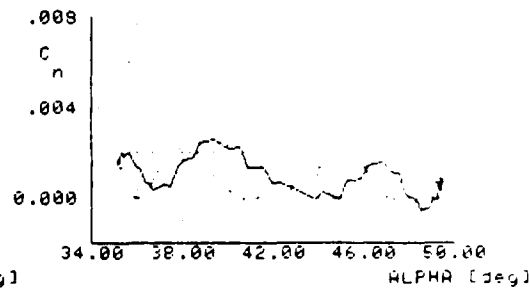
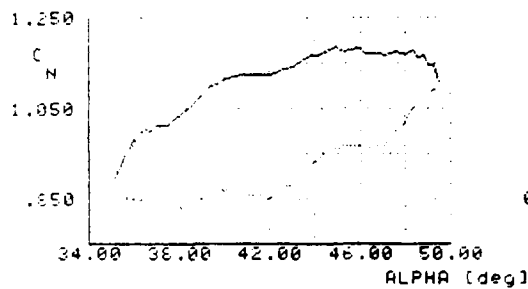


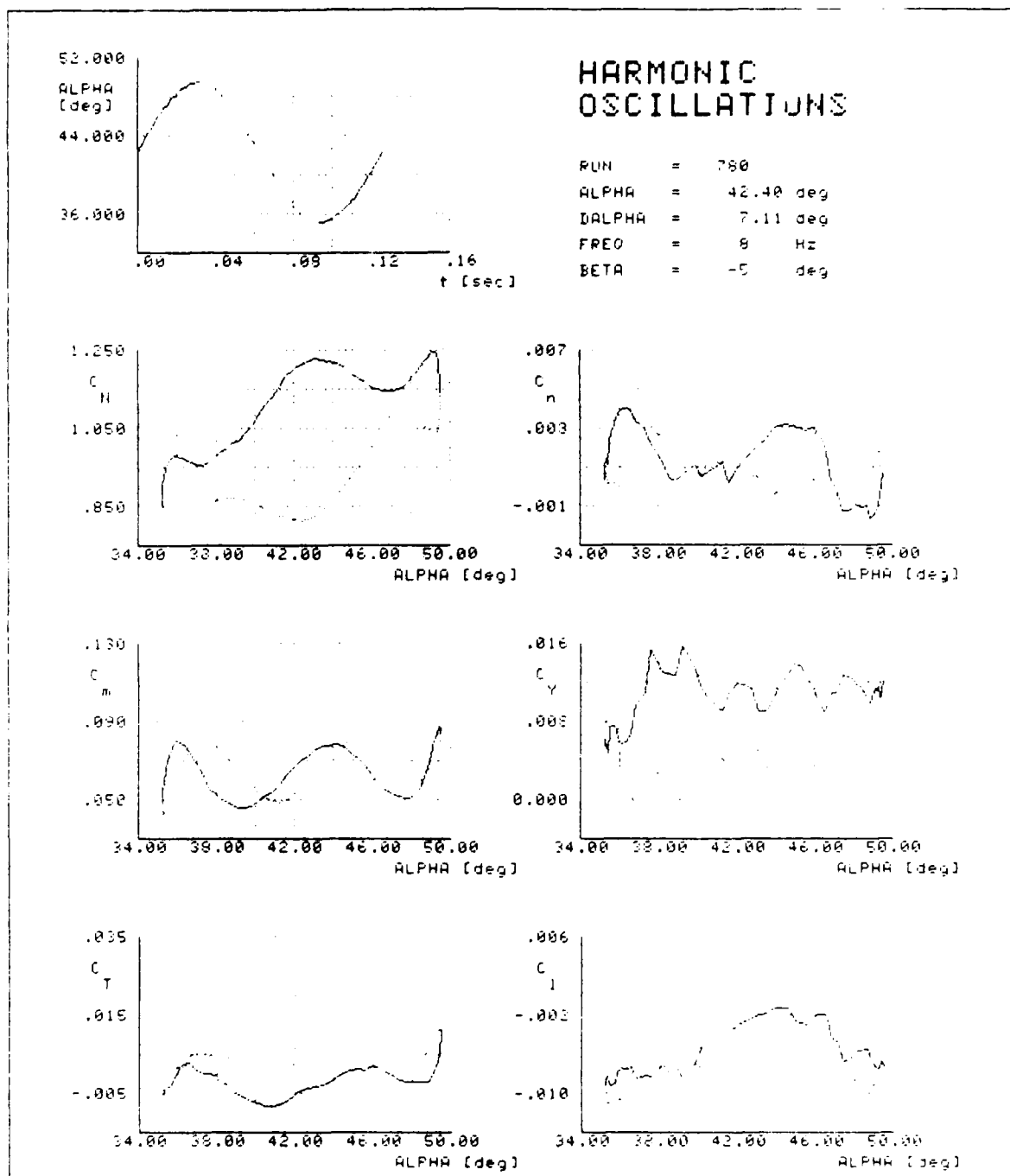


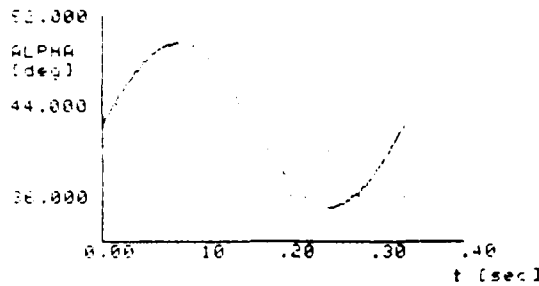


# HARMONIC OSCILLATIONS

RUN = 777  
 ALPHA = 42.36 deg  
 DALPHA = 7.14 deg  
 FREQ = 5 Hz  
 BETA = -5 deg

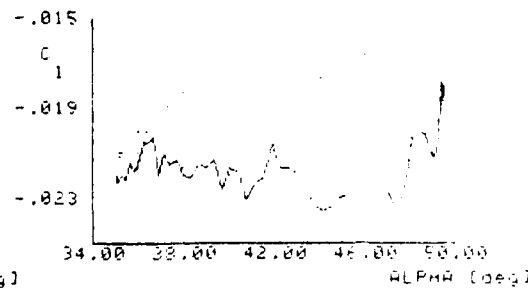
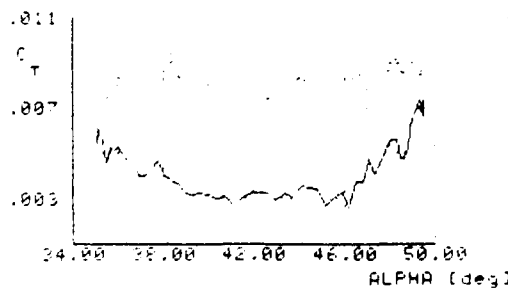
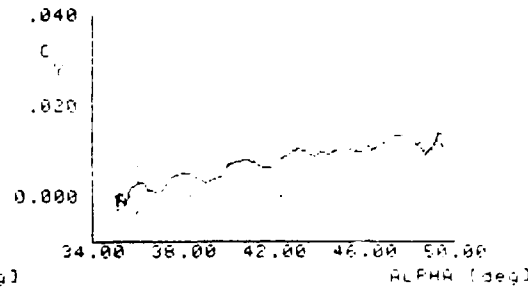
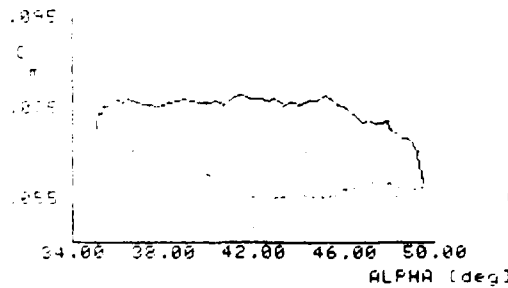
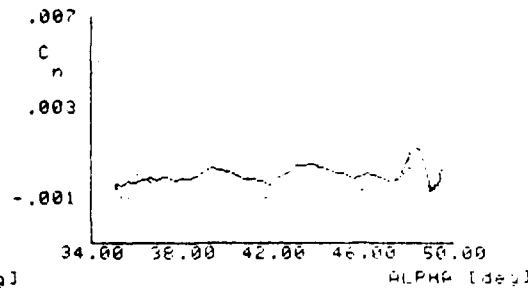
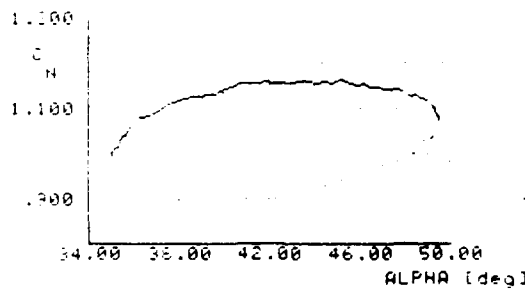


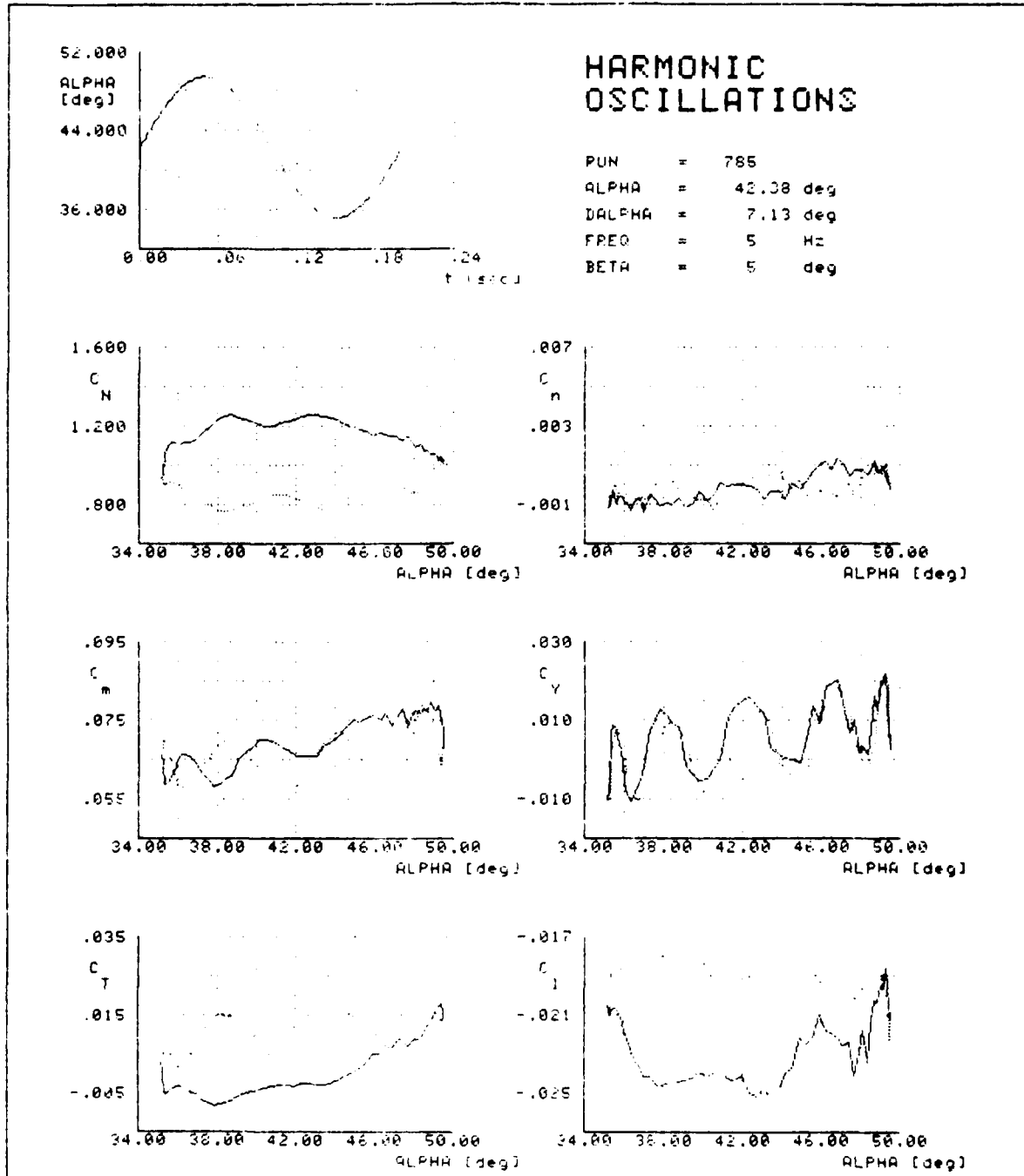


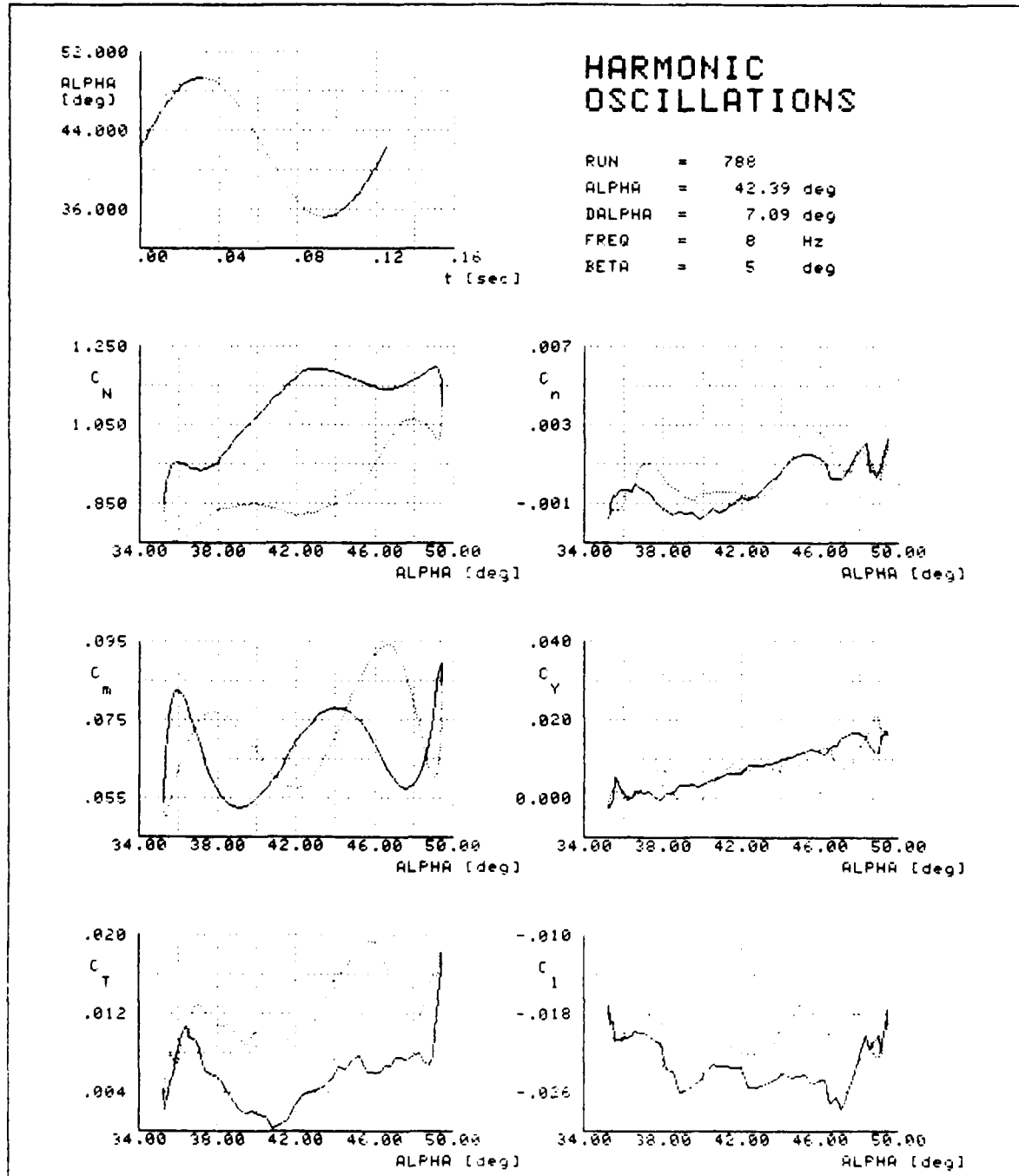


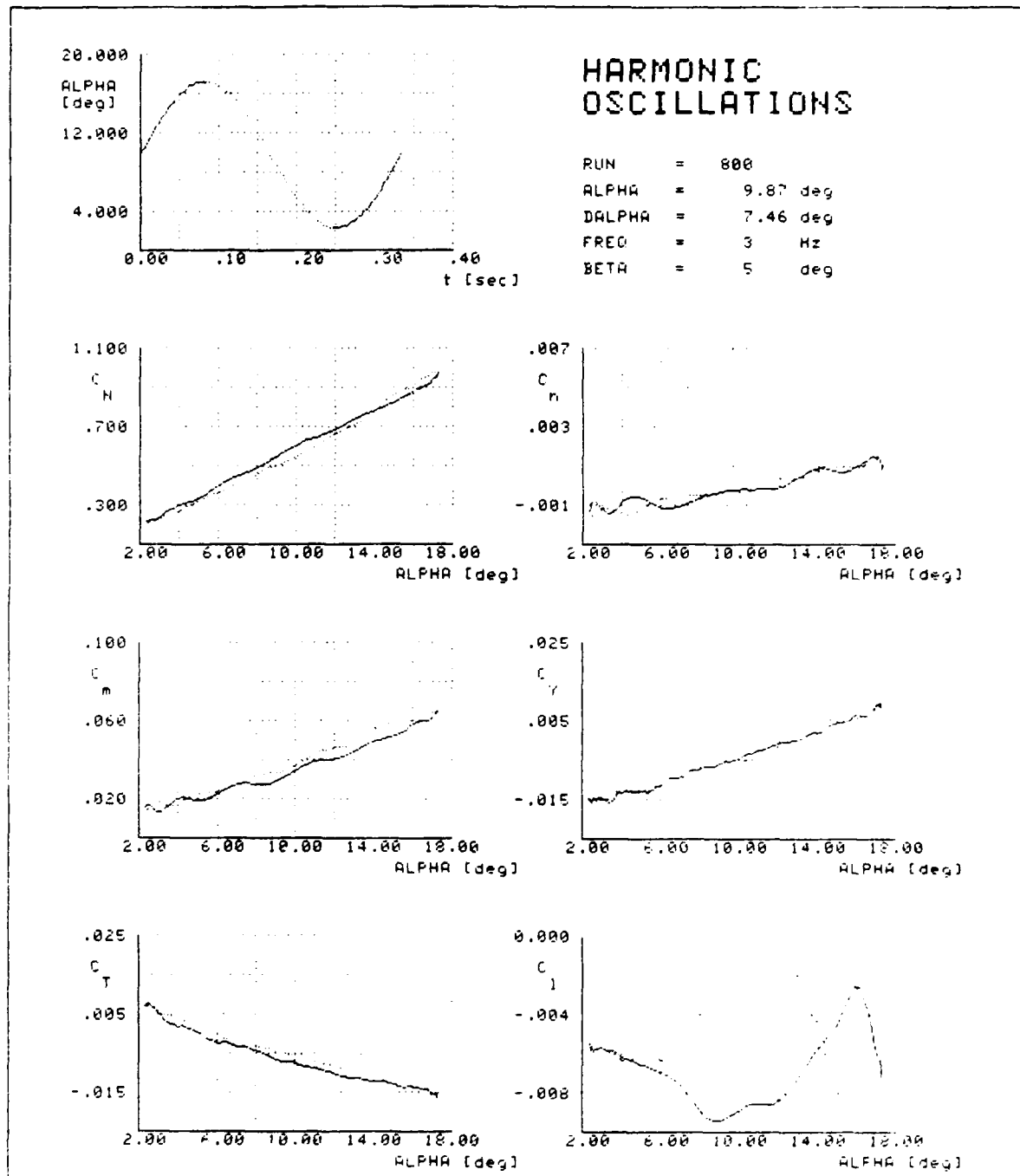
# HARMONIC OSCILLATIONS

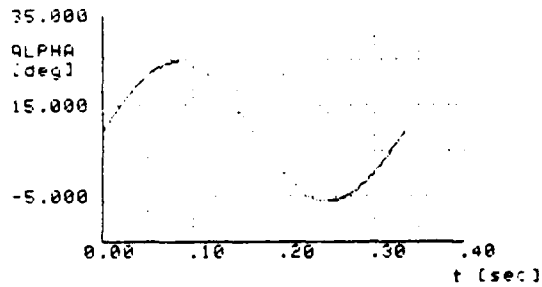
RUN = 703  
ALPHA = 42.31 deg  
DALPHA = 7.22 deg  
FREQ = 3 Hz  
BETA = 5 deg





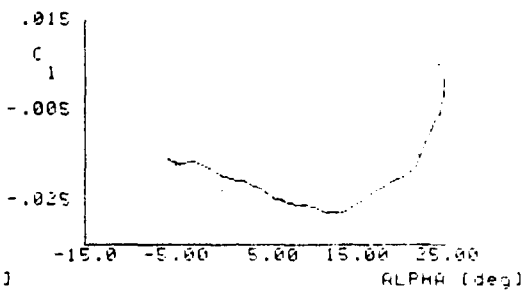
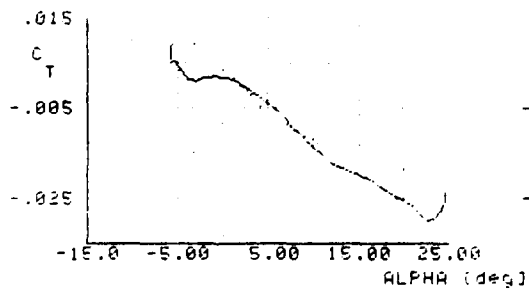
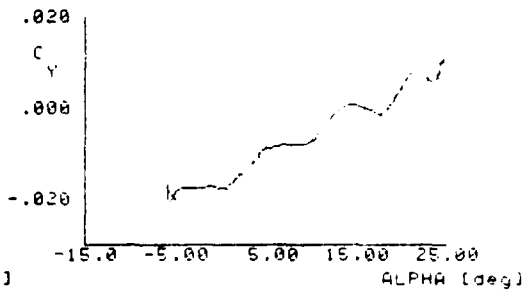
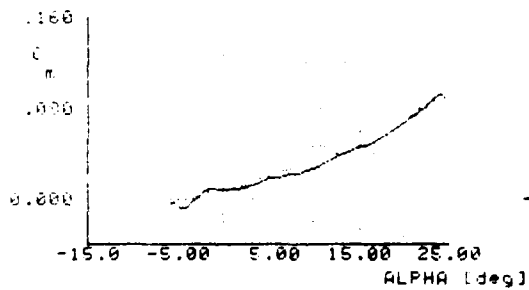
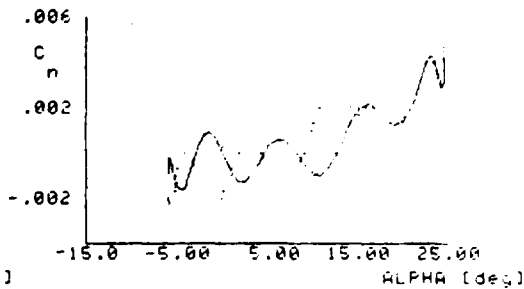
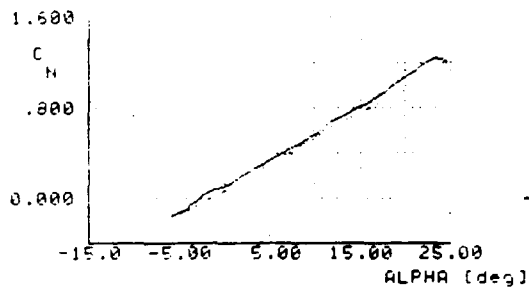


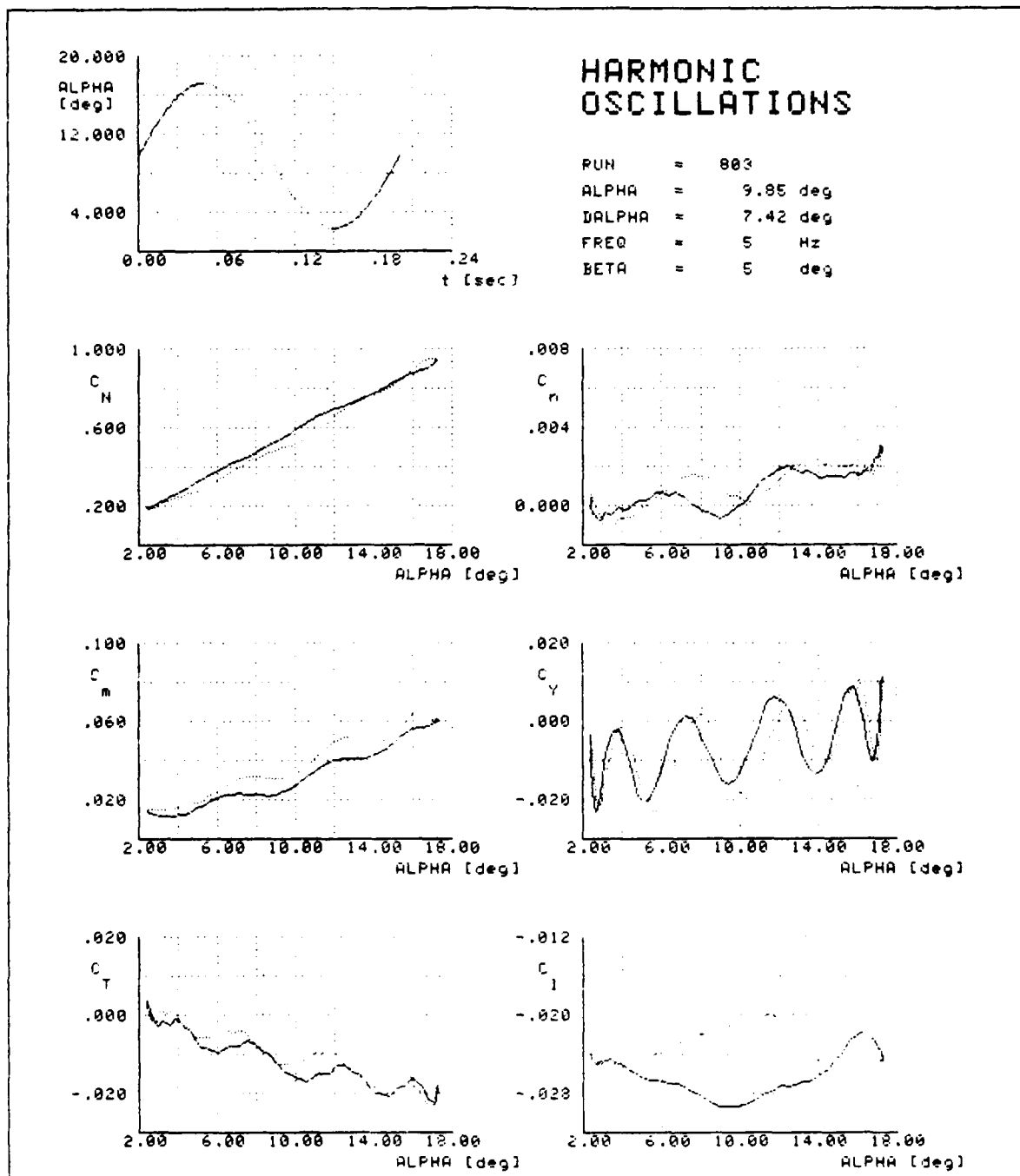




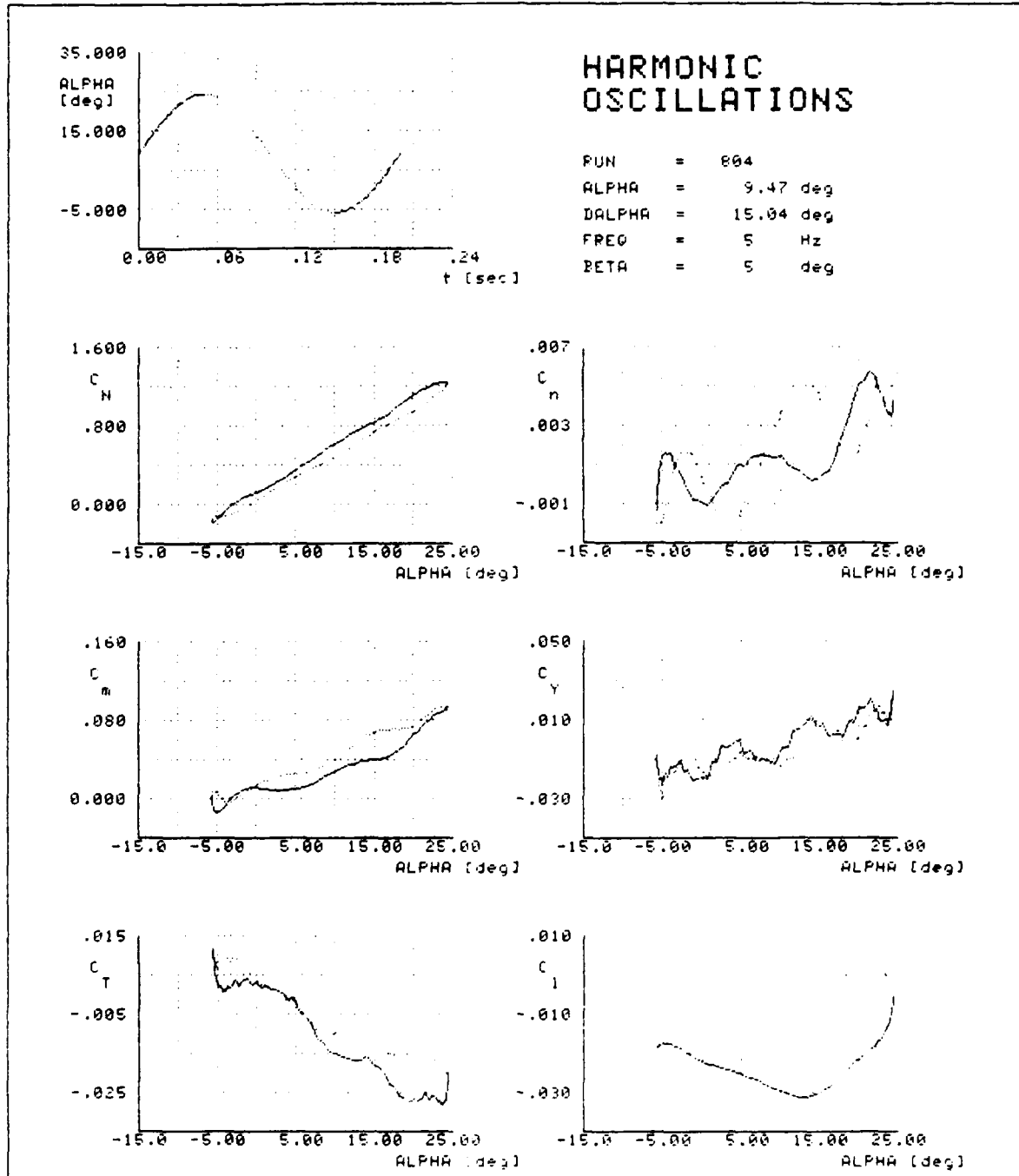
# HARMONIC OSCILLATIONS

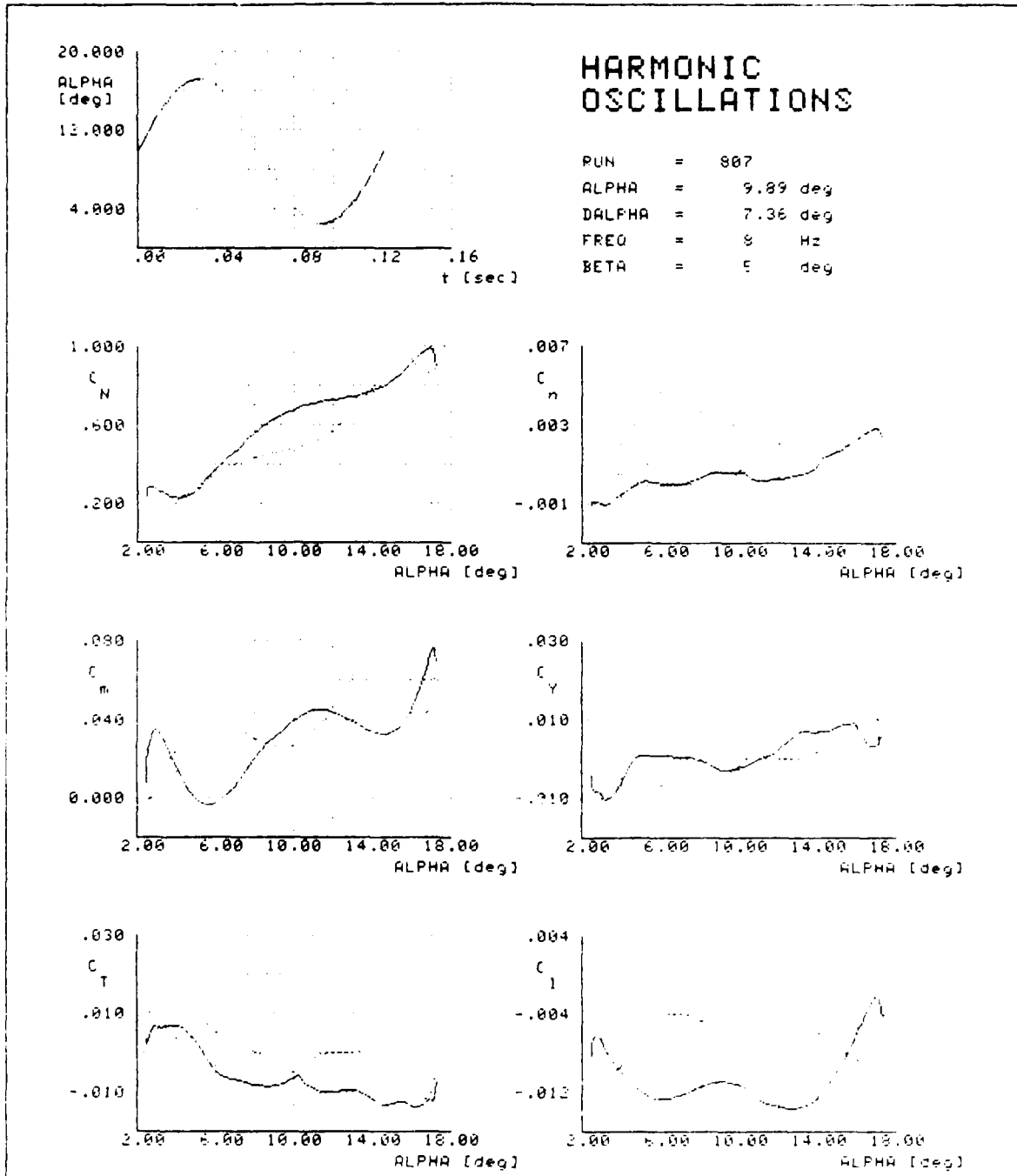
RUN = 801  
ALPHA = 9.44 deg  
DALPHA = 15.26 deg  
FREQ = 3 Hz  
BETA = 5 deg

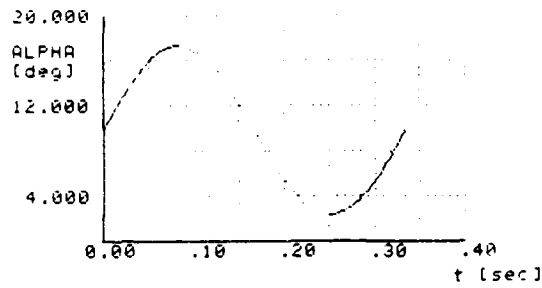






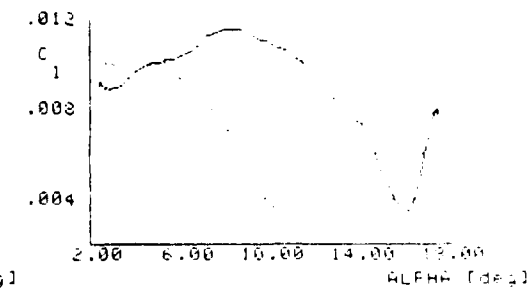
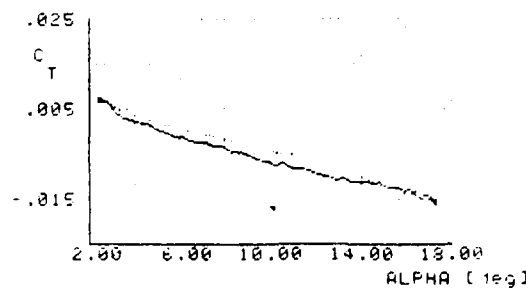
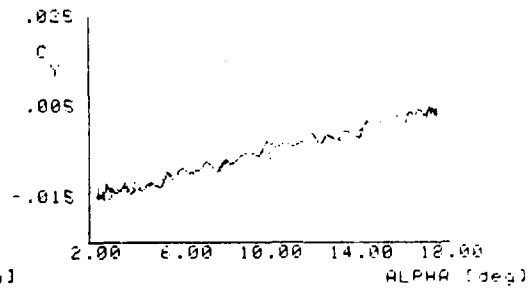
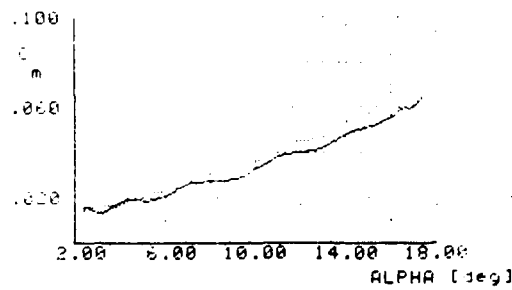
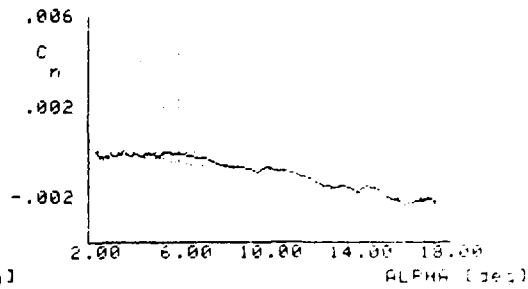
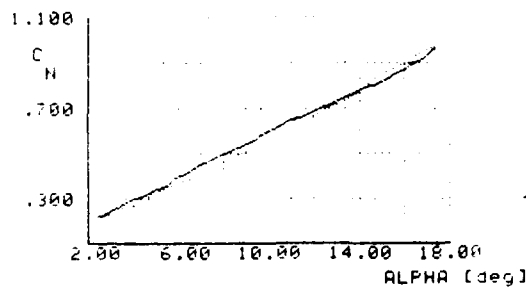


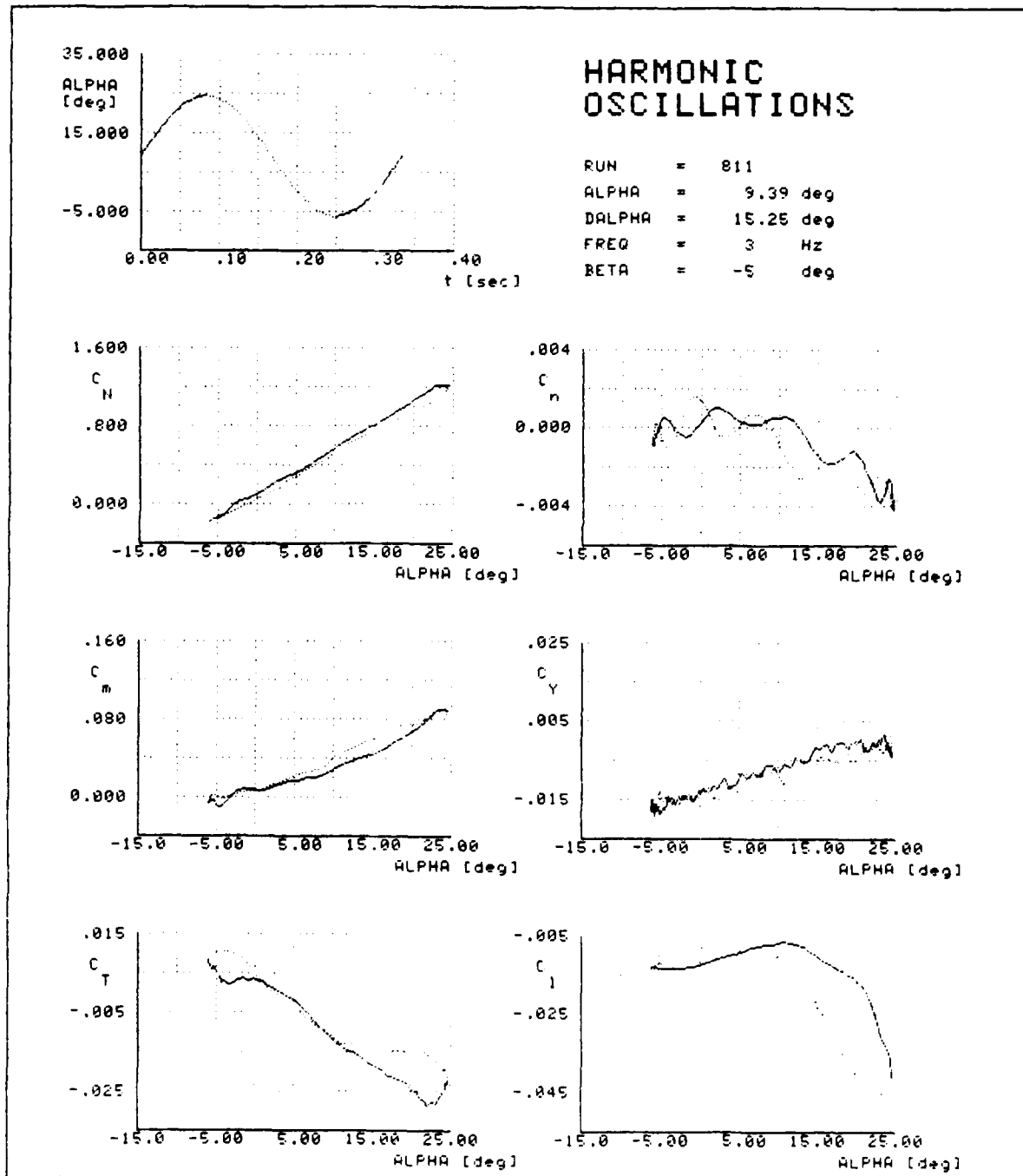


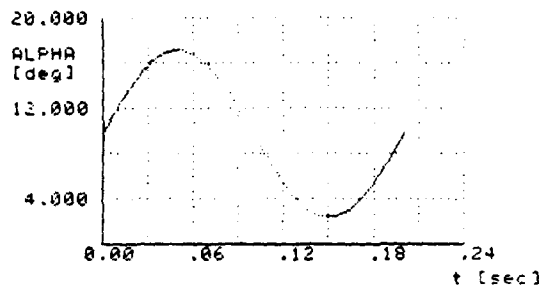


# HARMONIC OSCILLATIONS

RUN = 810  
ALPHA = 9.90 deg  
DALPHA = 7.48 deg  
FREQ = 3 Hz  
BETA = -5 deg

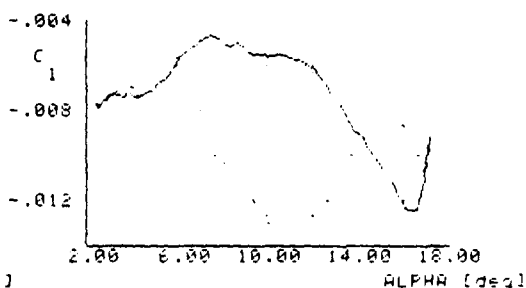
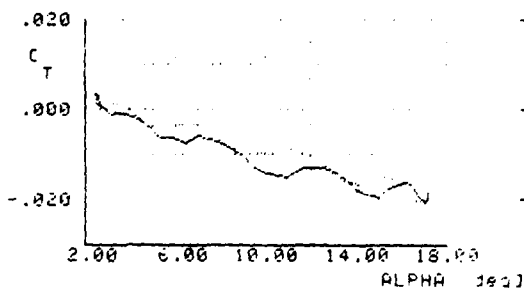
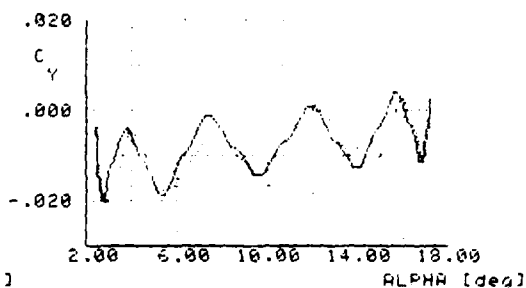
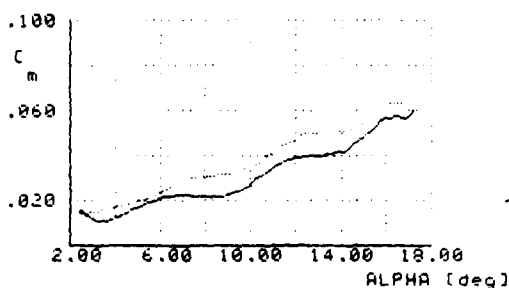
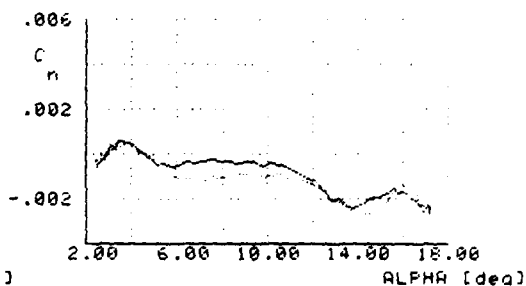
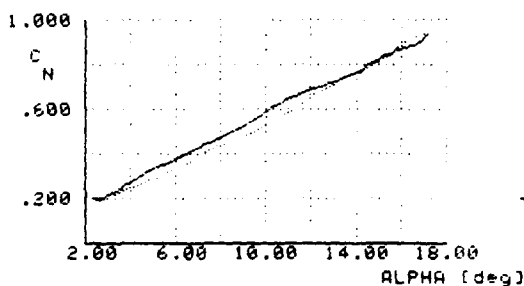


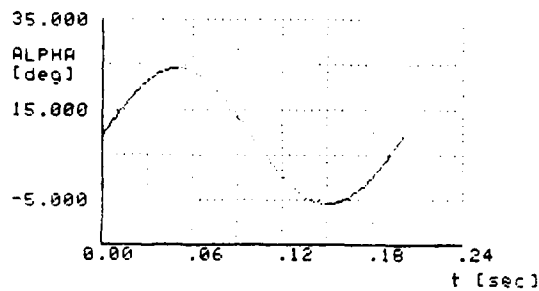




# HARMONIC OSCILLATIONS

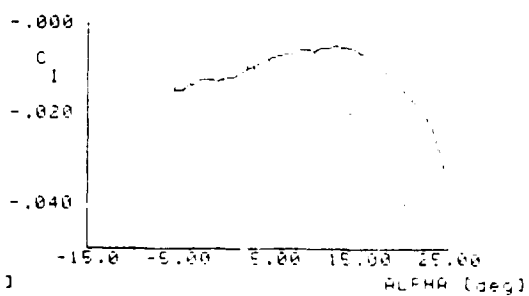
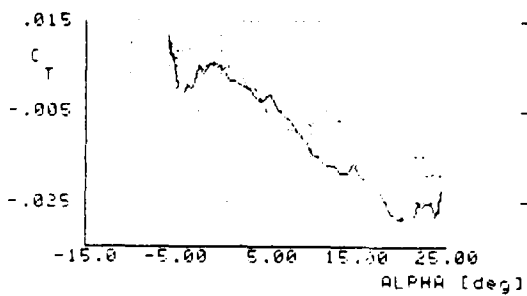
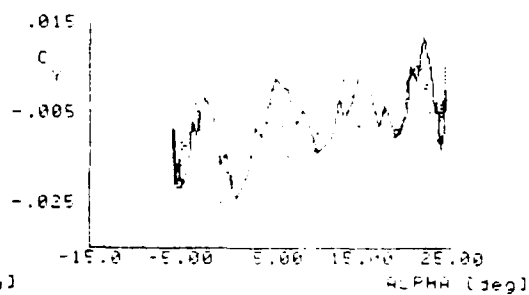
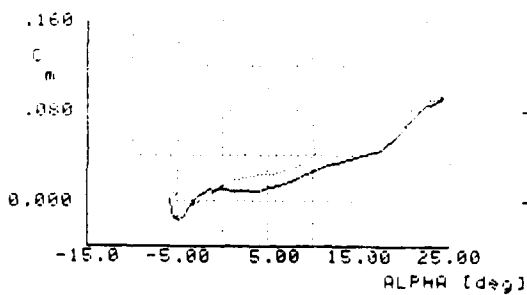
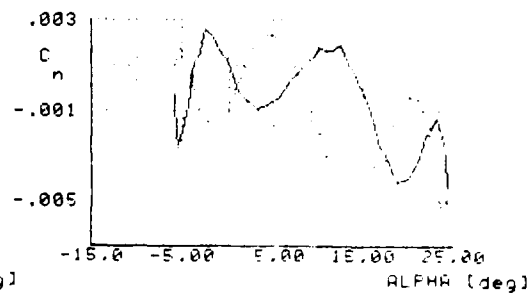
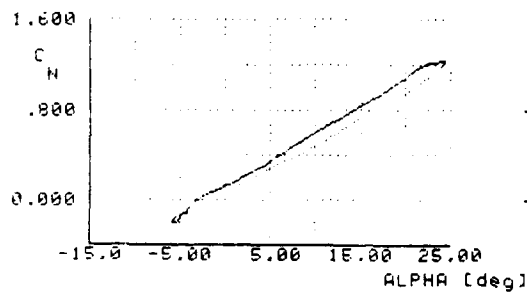
RUN = 813  
 ALPHA = 9.86 deg  
 DALPHA = 7.37 deg  
 FREQ = 5 Hz  
 BETA = -5 deg

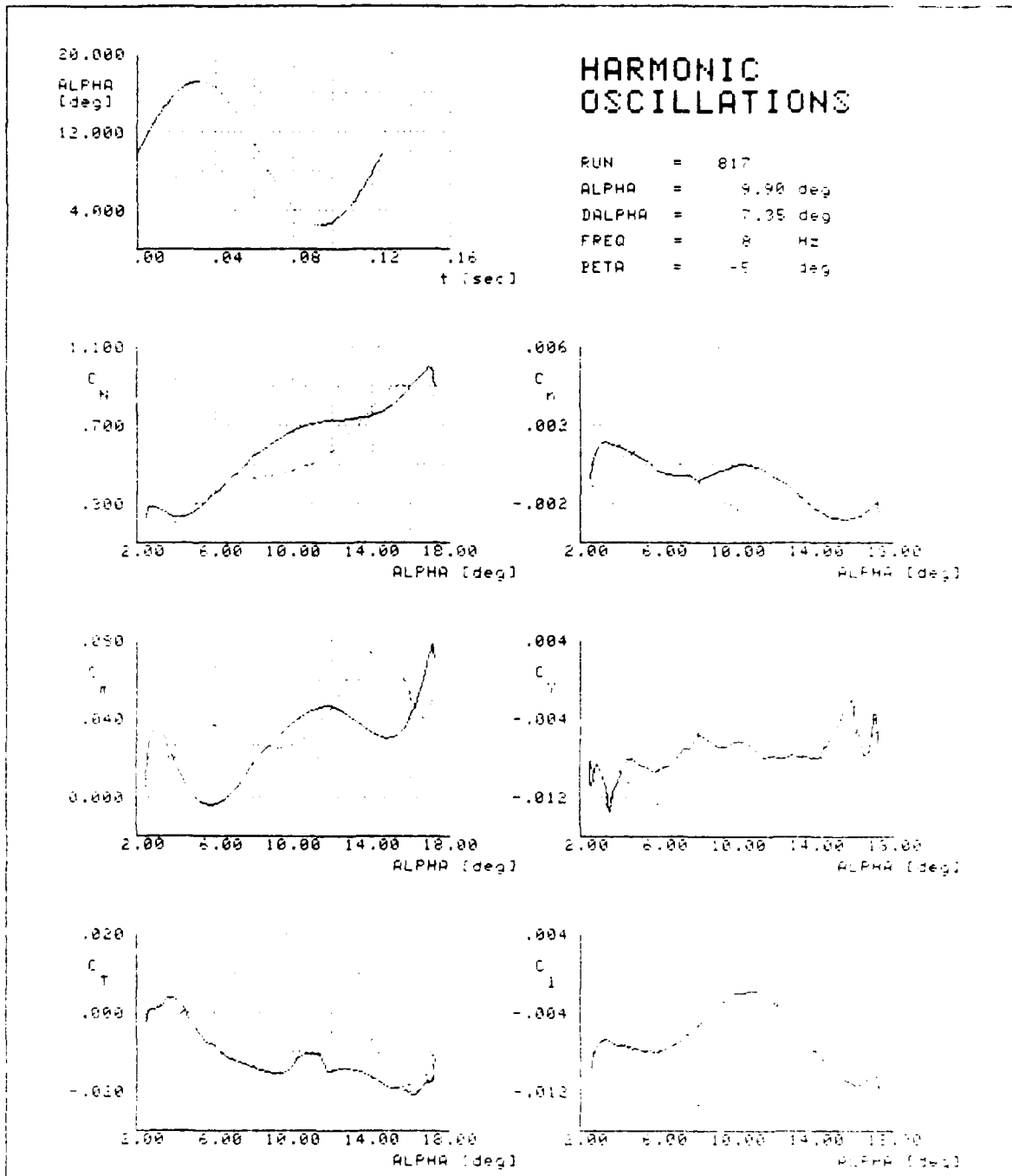


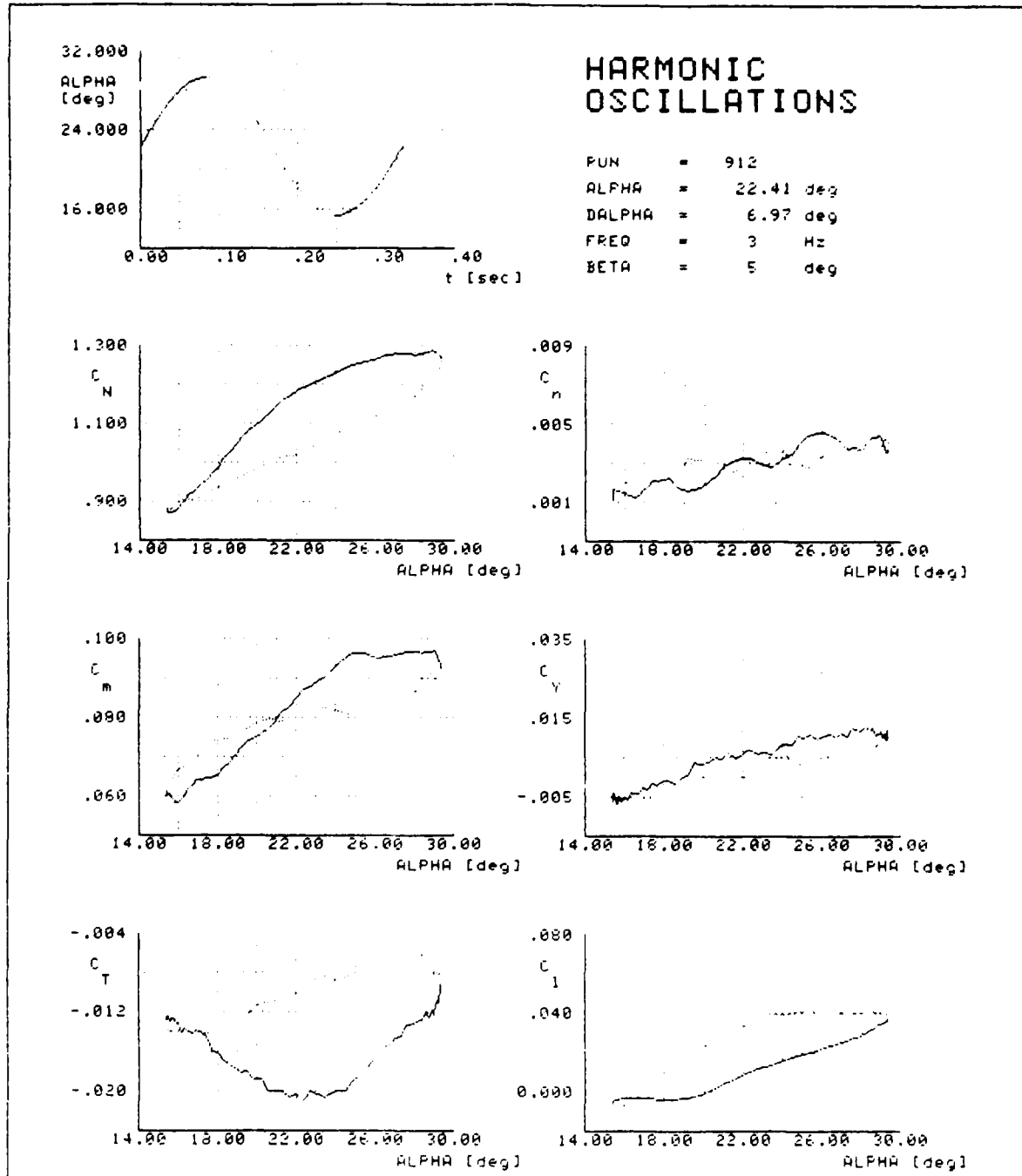


# HARMONIC OSCILLATIONS

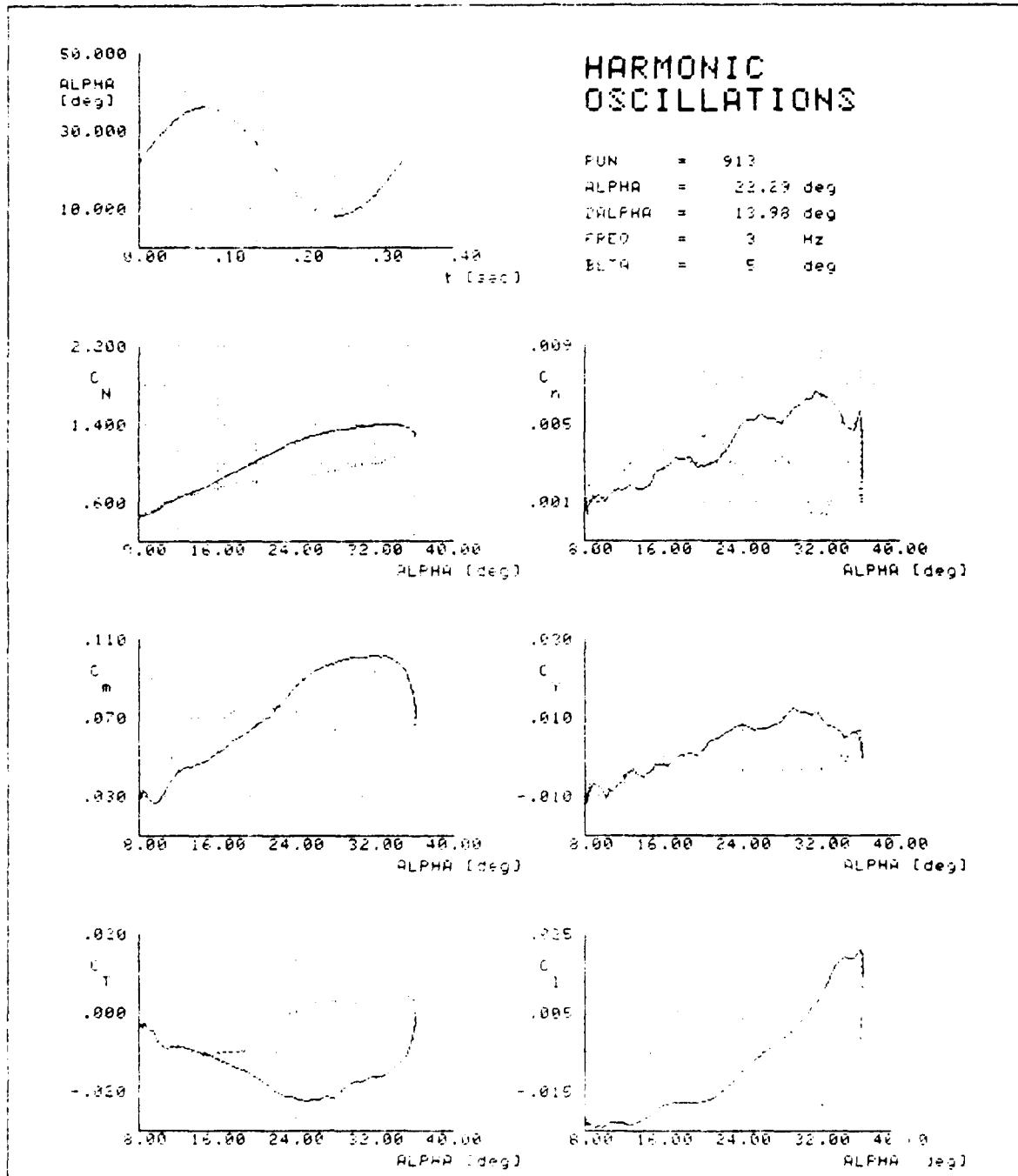
RUN = 014  
 ALPHA = 9.39 deg  
 DALPHA = 15.06 deg  
 FREQ = 5 Hz  
 BETA = -5 deg

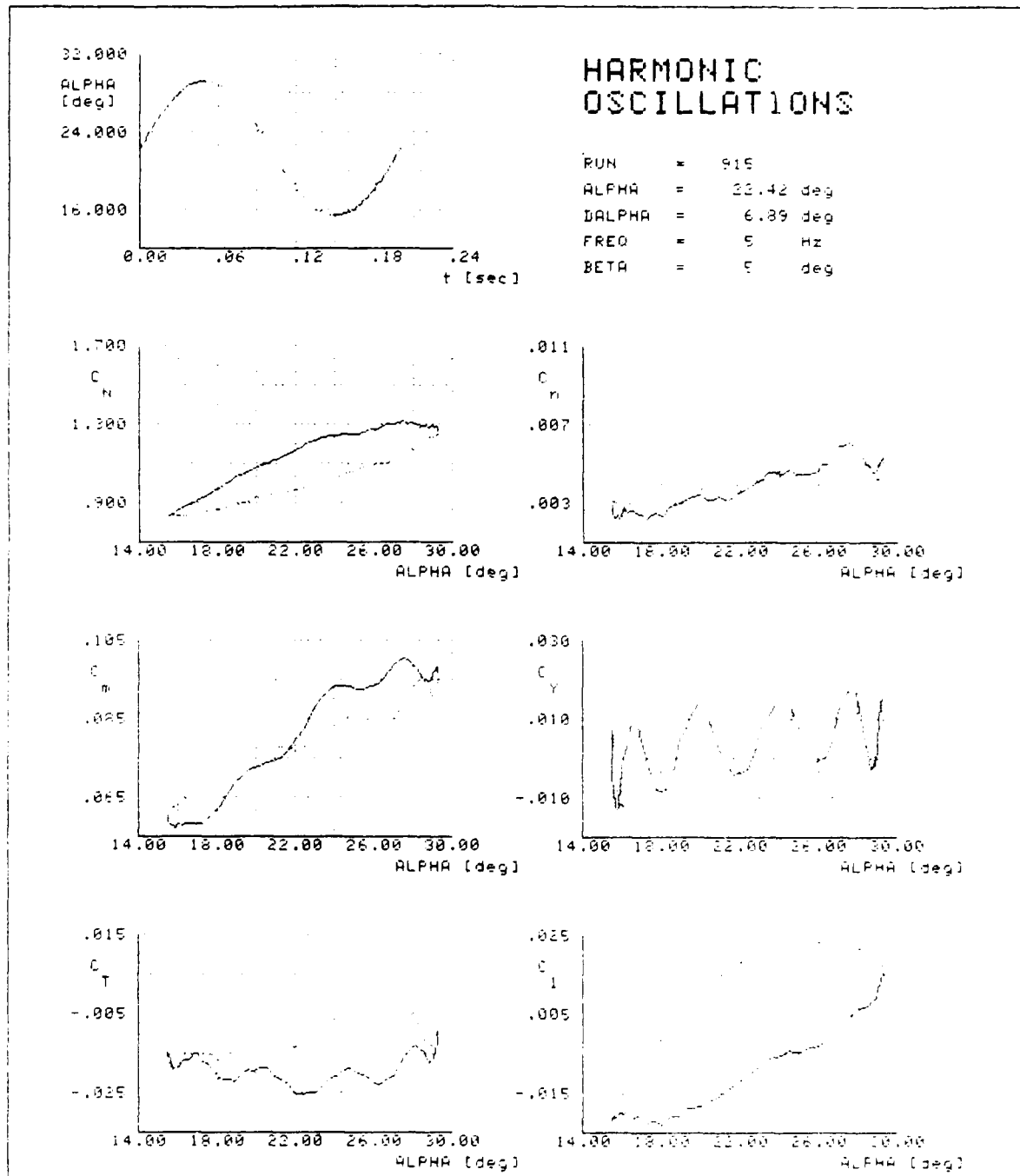


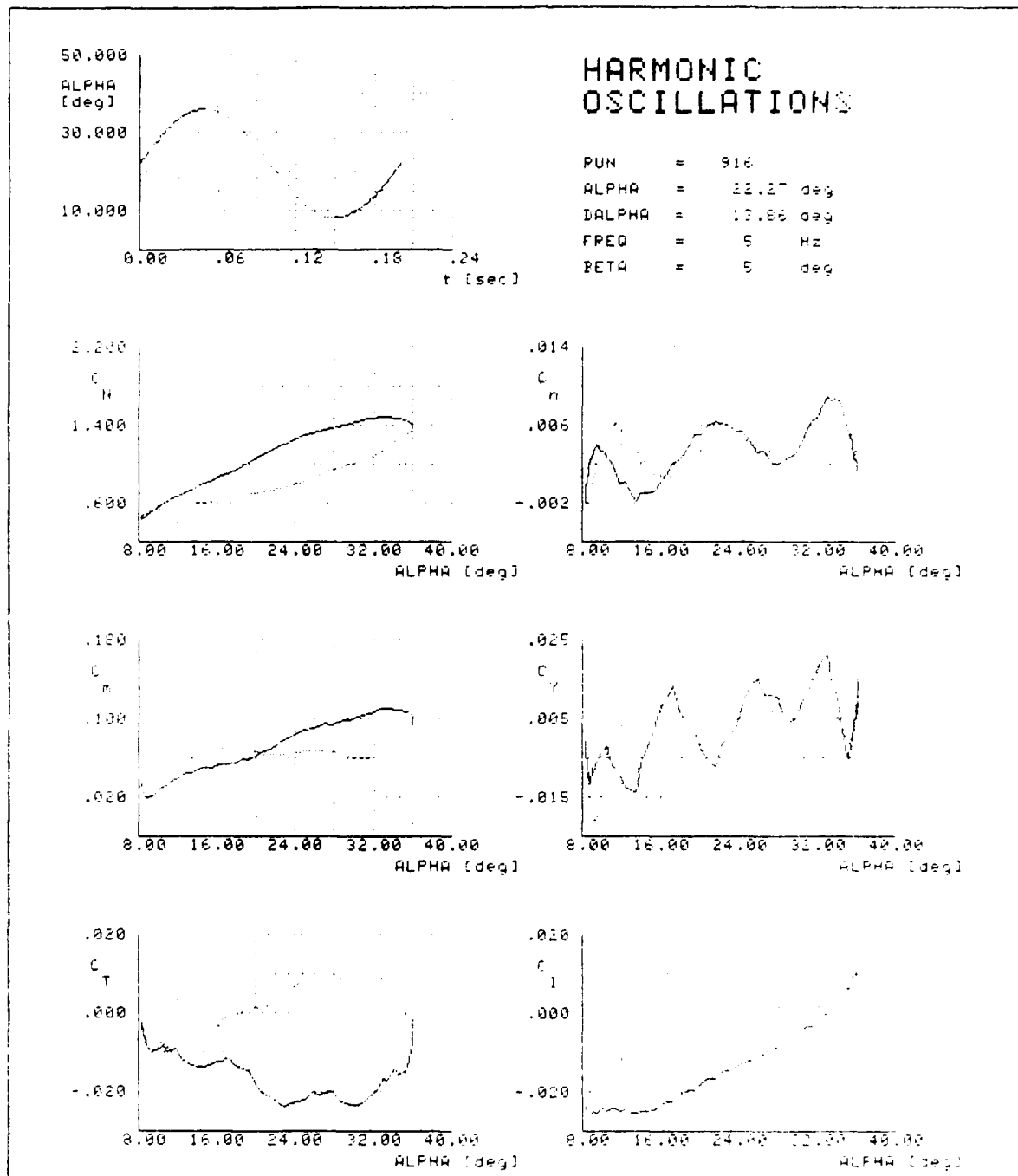


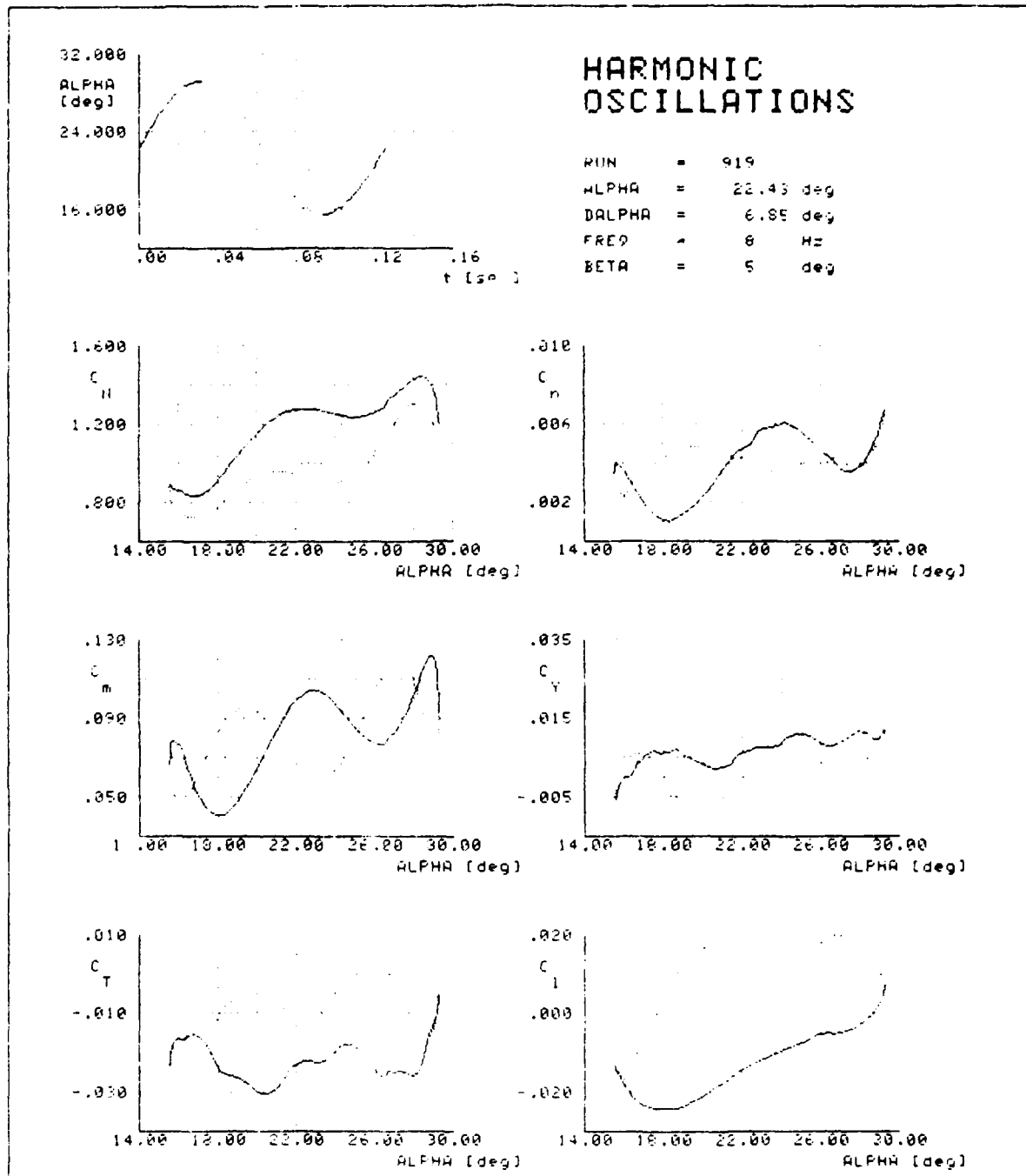


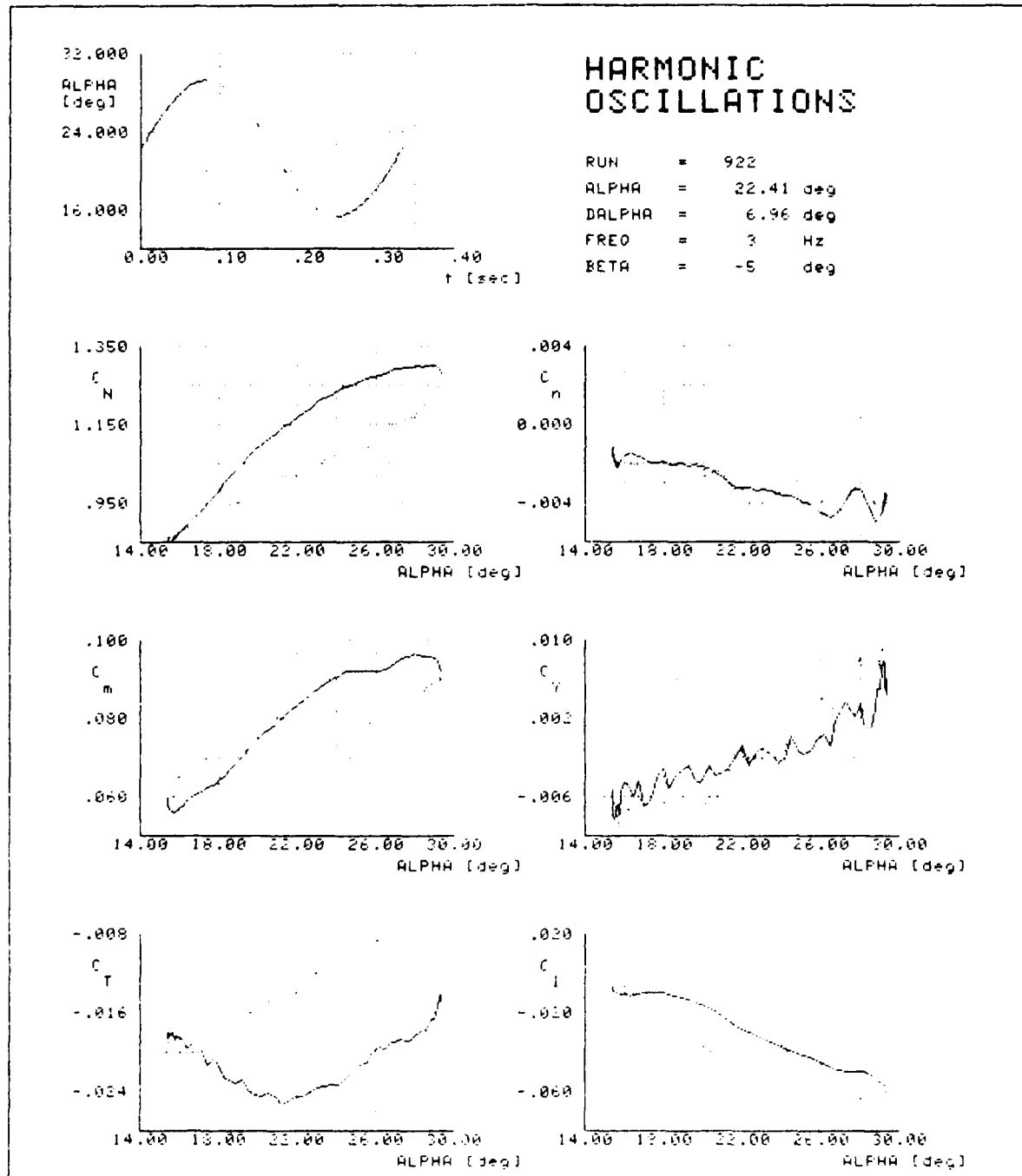


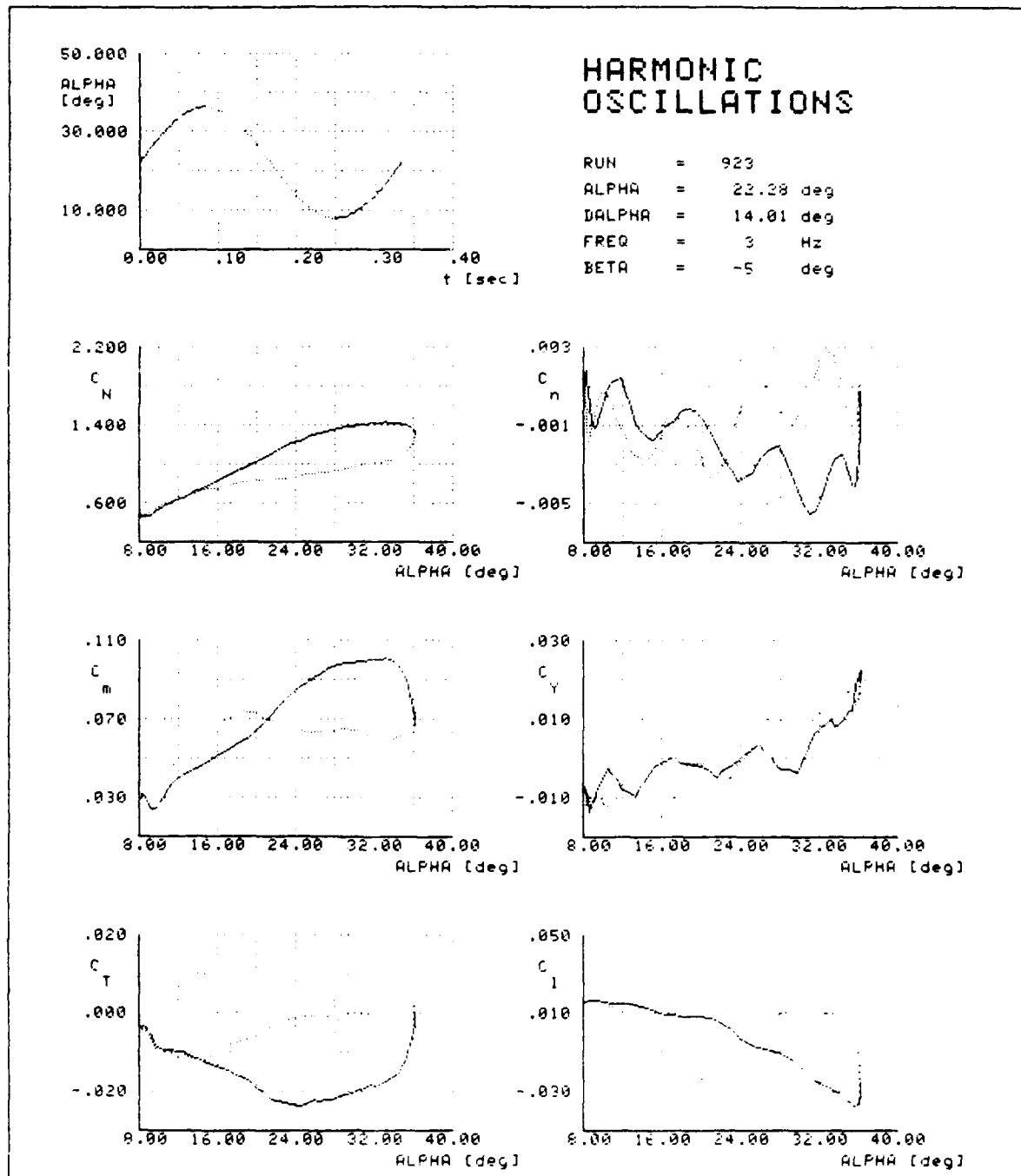


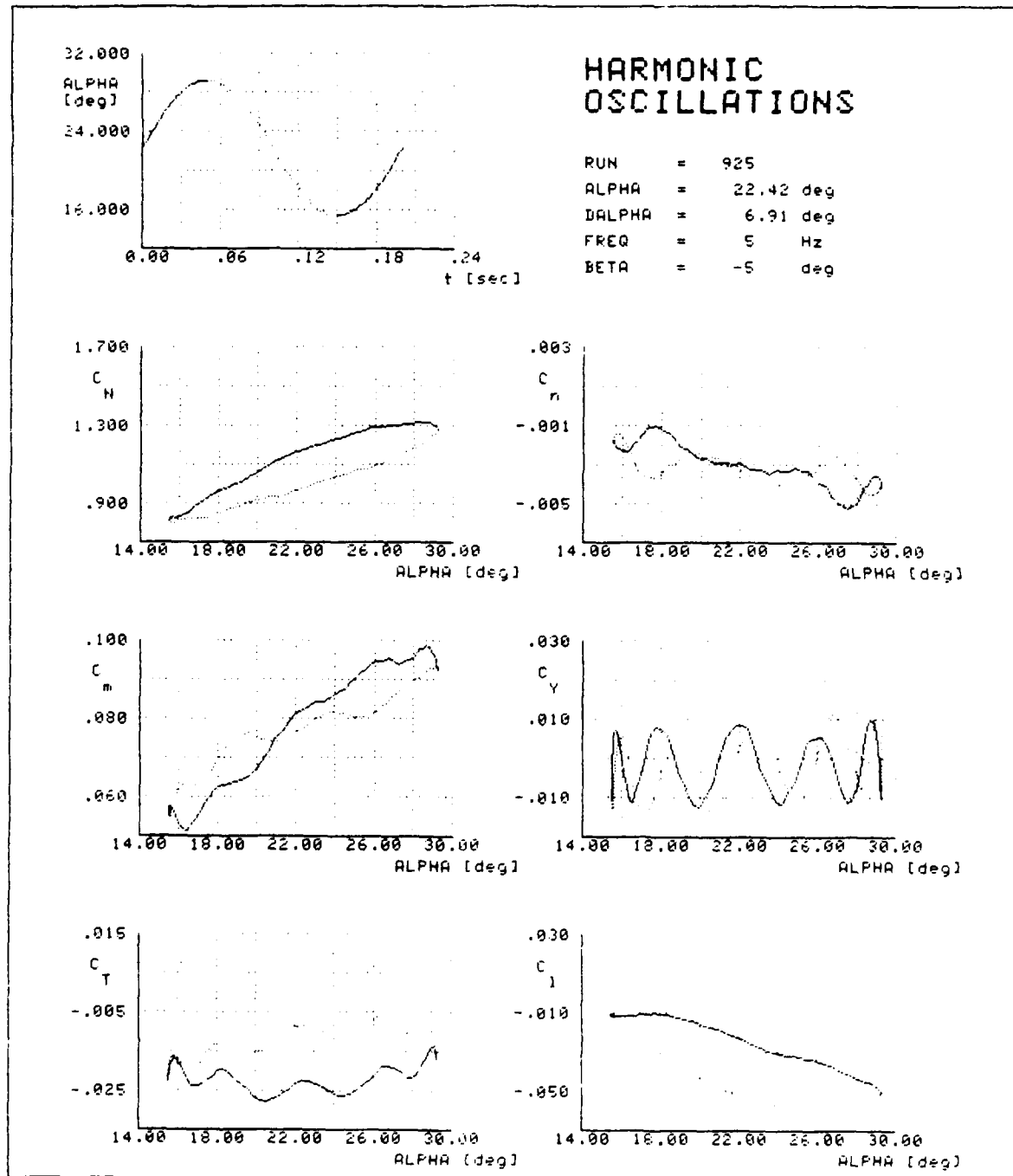


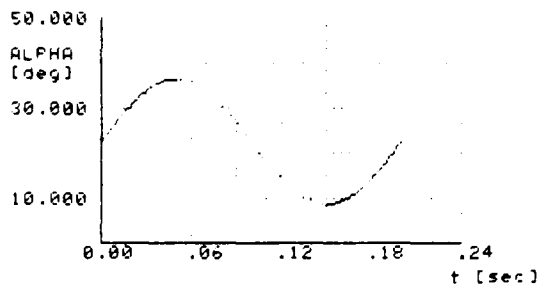






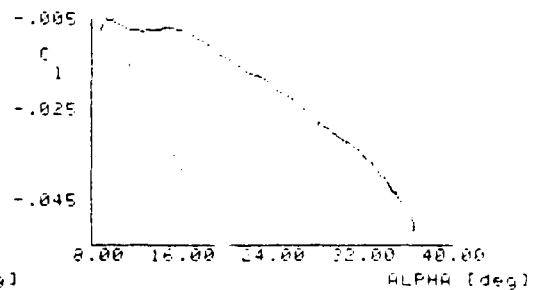
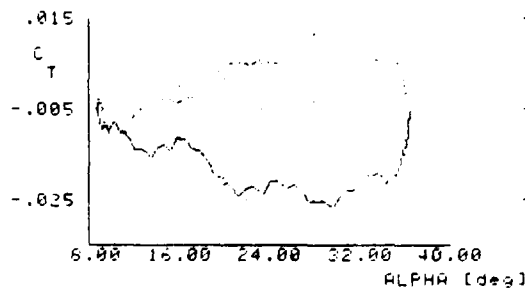
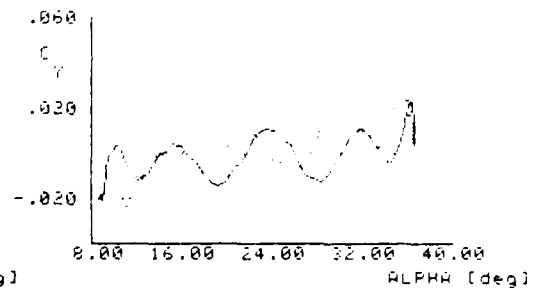
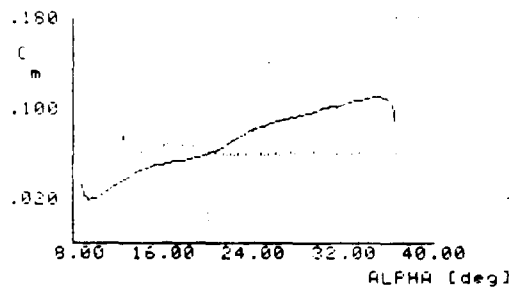
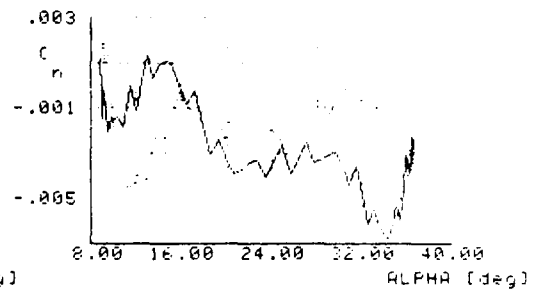
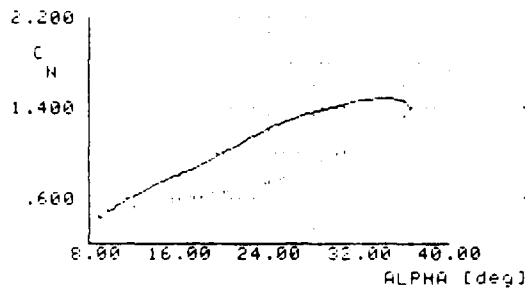




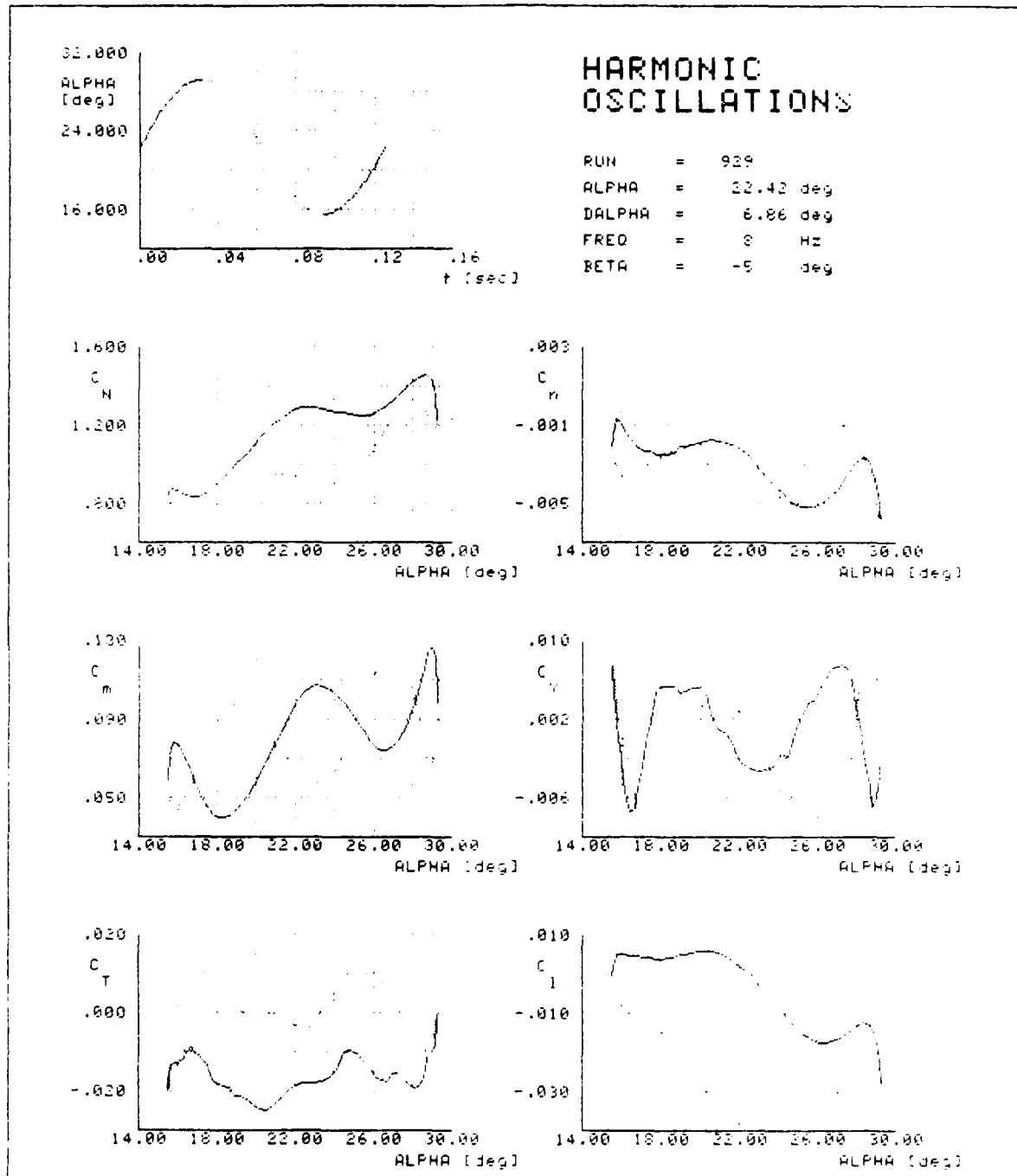


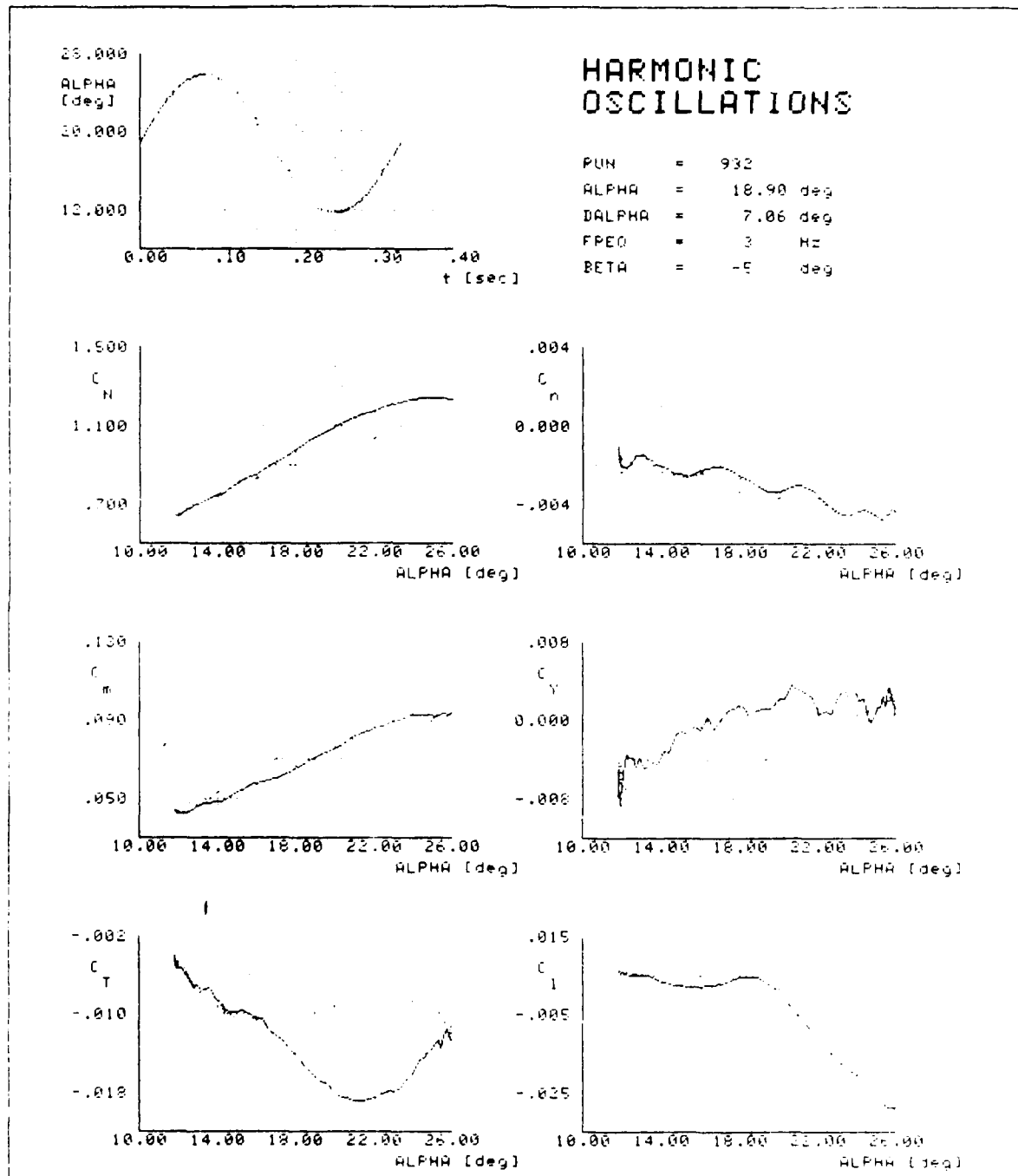
# HARMONIC OSCILLATIONS

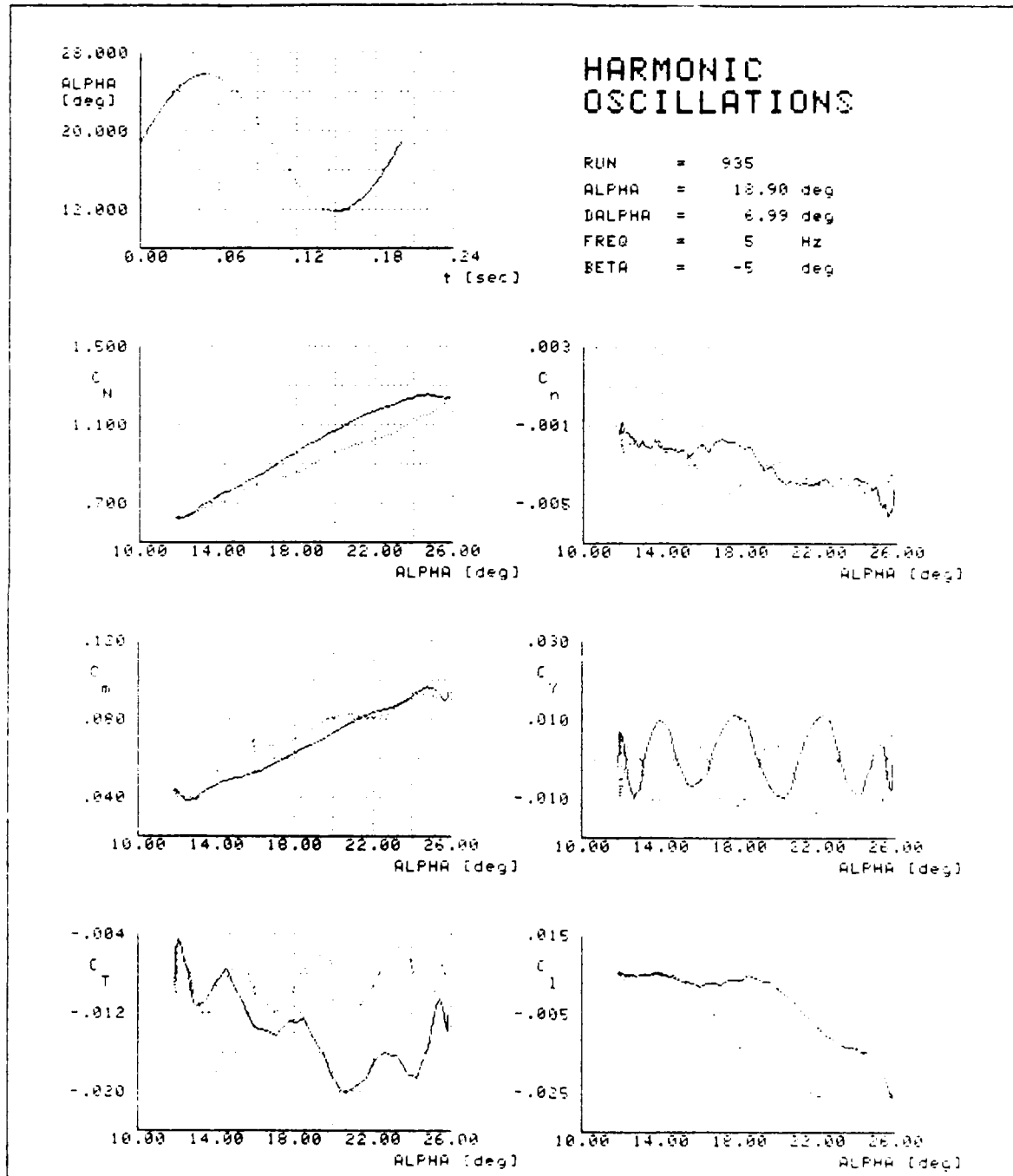
RUN = 926  
ALPHA = 22.82 deg  
DALPHA = 13.84 deg  
FREQ = 5 Hz  
BETA = -5 deg

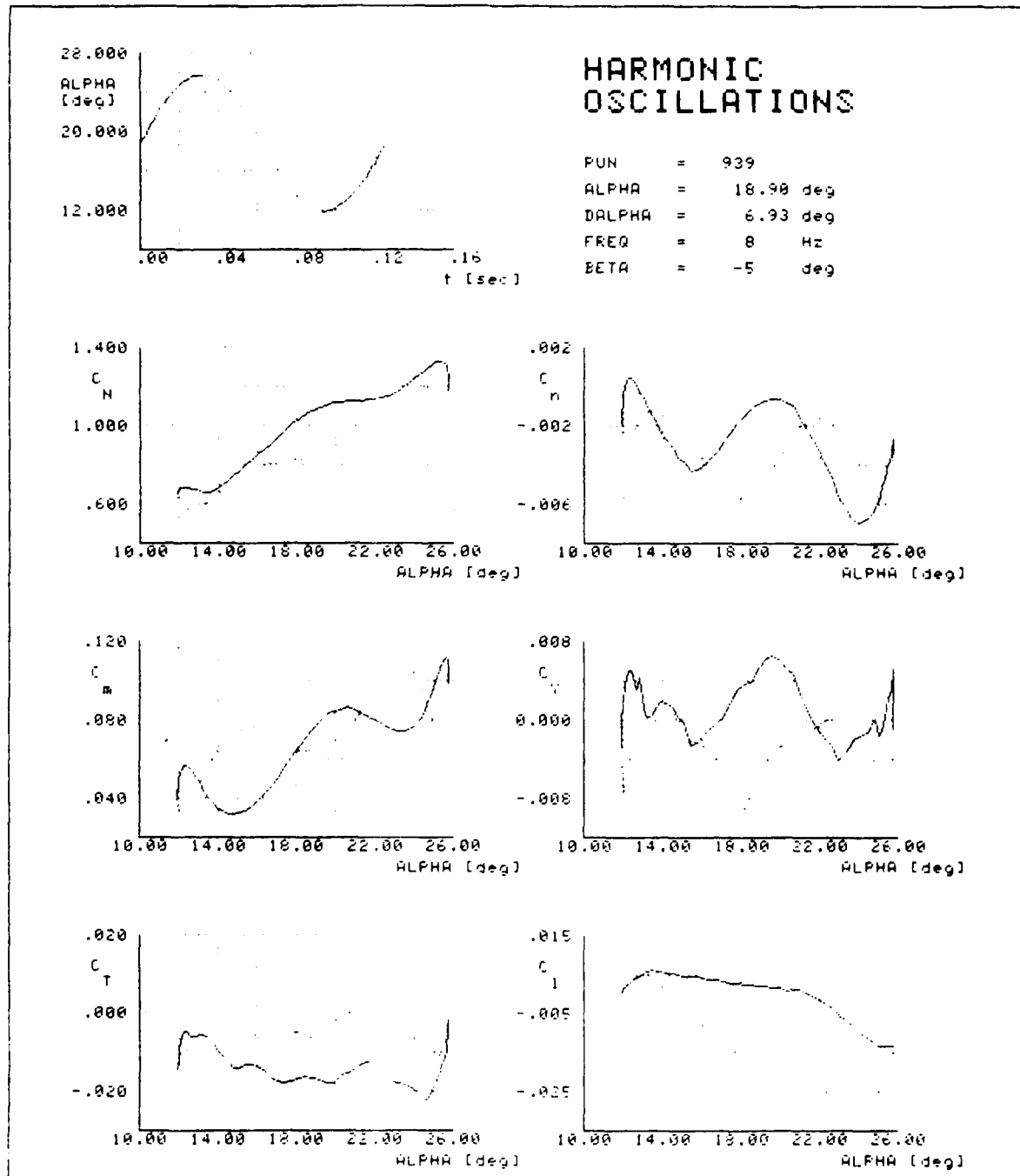


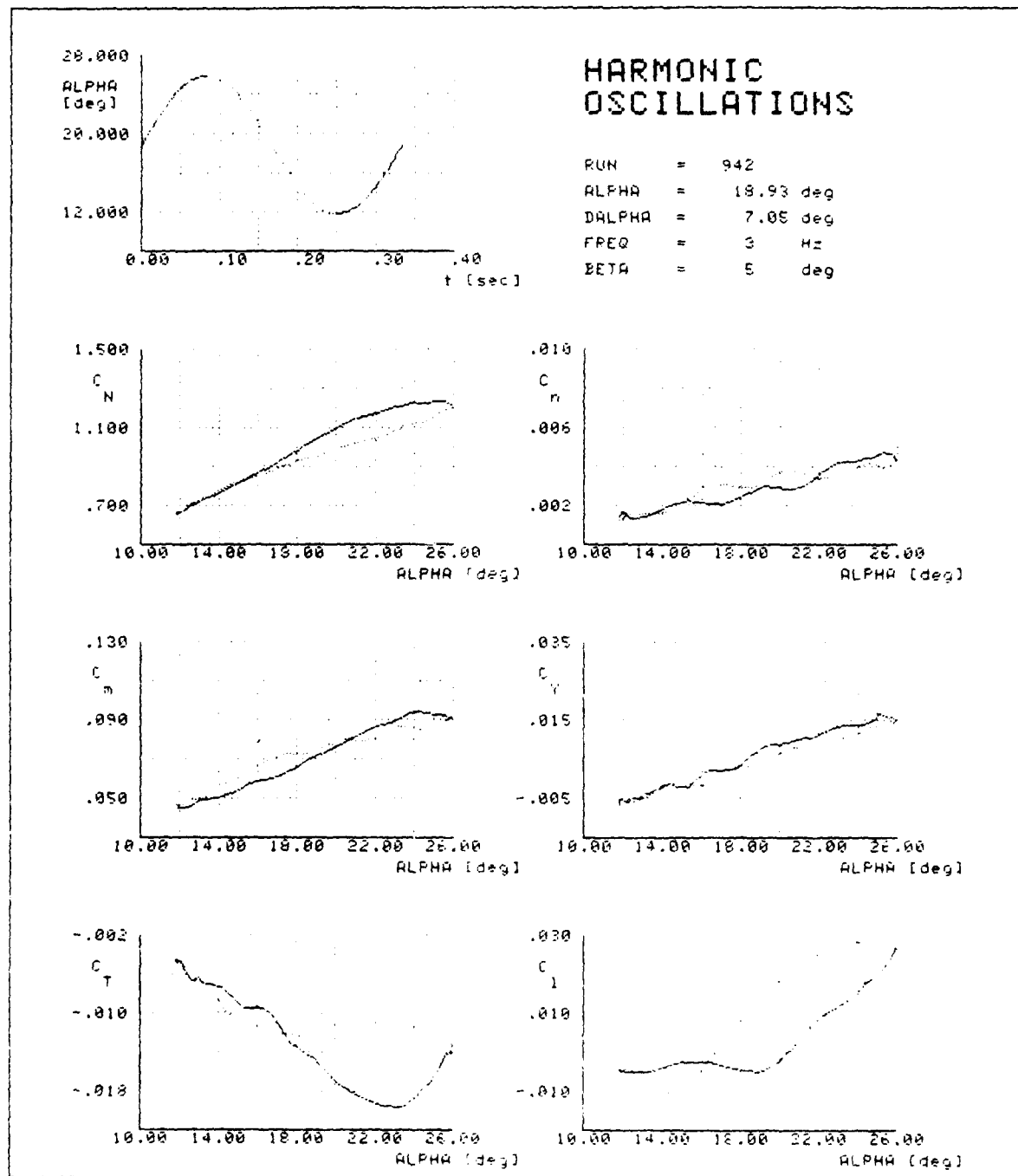


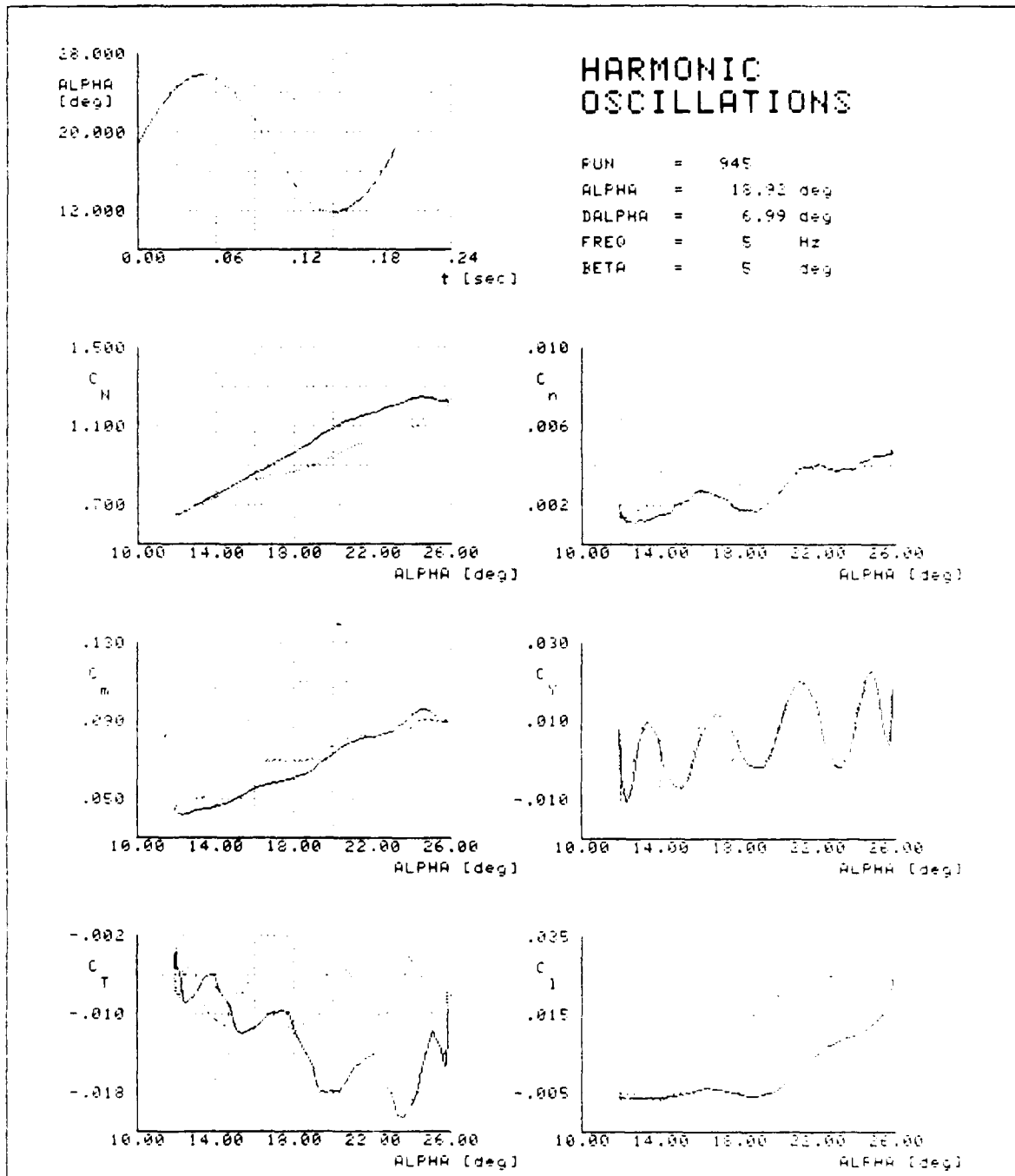


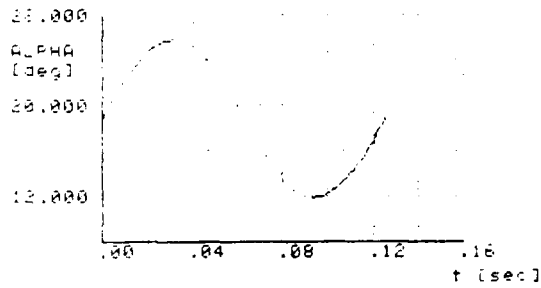






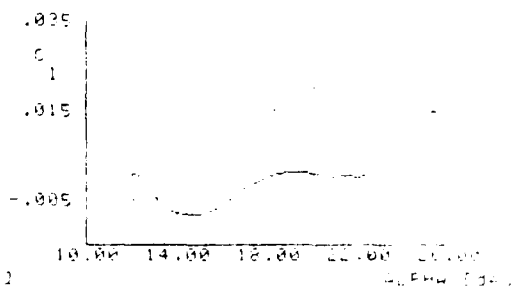
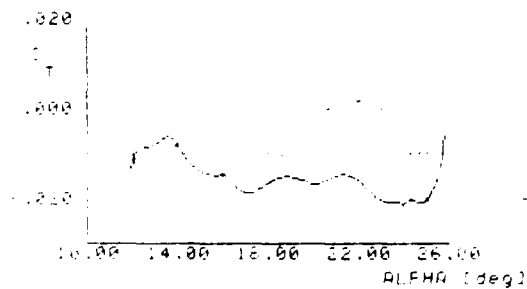
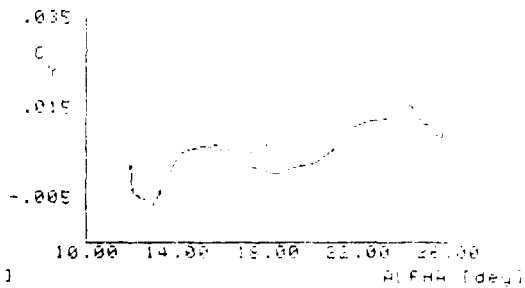
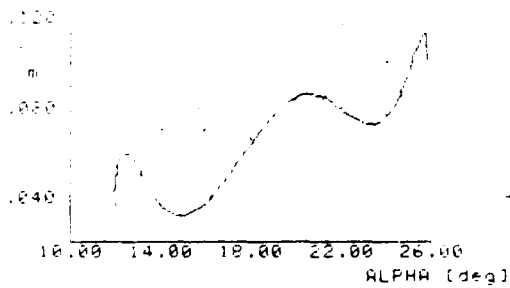
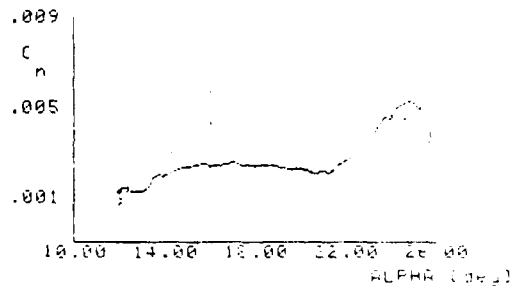
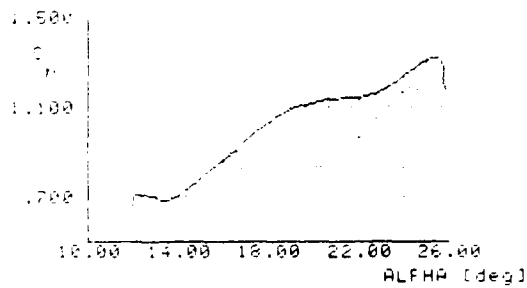






# HARMONIC OSCILLATIONS

RUN = 949  
ALPHA = 18.92 deg  
DALPHA = 6.92 deg  
FREQ = 6 Hz  
BETA = 5 deg



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